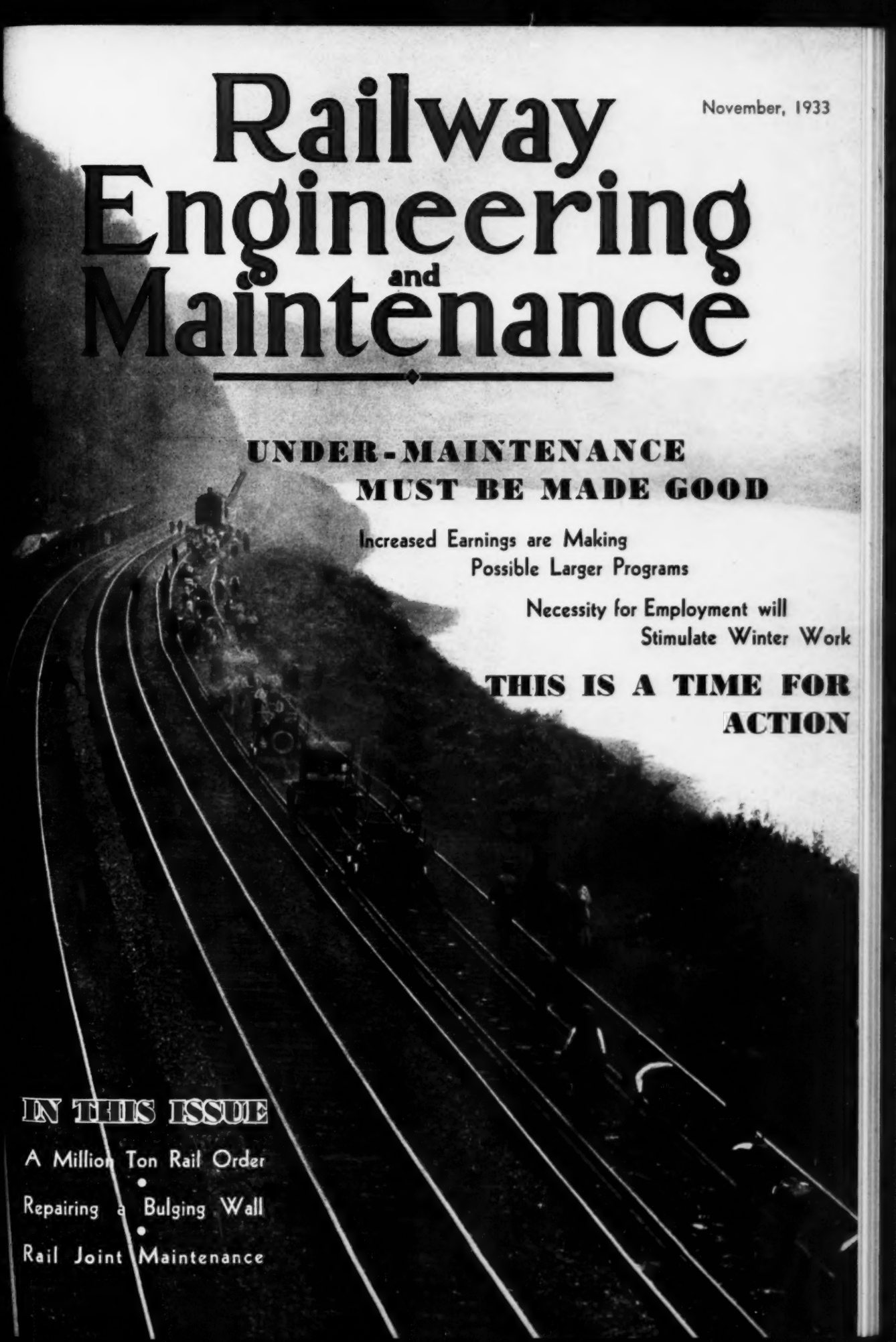
November, 1933

# Railway Engineering and Maintenance



## UNDER-MAINTENANCE MUST BE MADE GOOD

Increased Earnings are Making Possible Larger Programs

Necessity for Employment will Stimulate Winter Work

## THIS IS A TIME FOR ACTION

IN THIS ISSUE

A Million Ton Rail Order

Repairing a Bulging Wall

Rail Joint Maintenance

# WELD MORE *to* SAVE MORE

**BUILDING UP and HEAT TREATING rail ends with AIRCOWELDING, adds years to rail life.**

**These operations are performed most effectively with AIRCO Oxygen, Acetylene, Apparatus and Supplies.**

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**NEW YORK, N. Y.**

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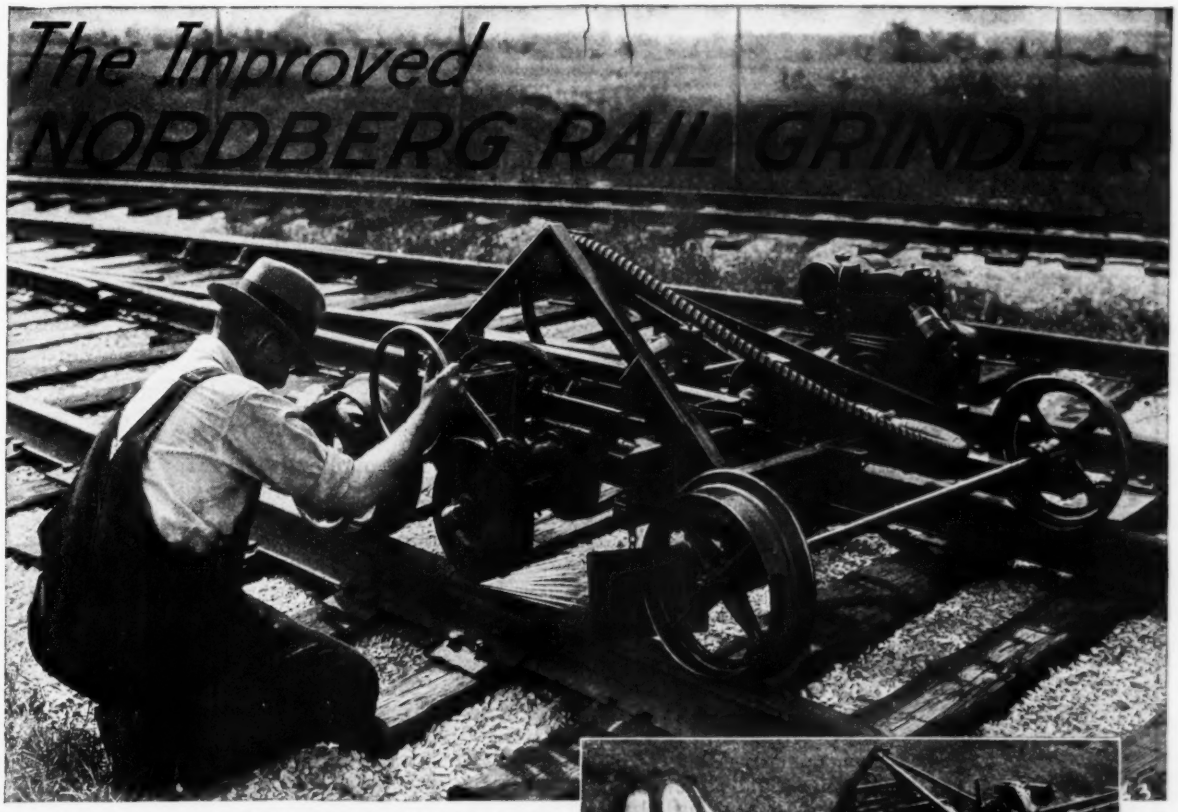


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No. 59 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

**Subject:** A Common Objective

October 26, 1933

Dear Reader:

In these days we are all so busy solving our own individual problems that we have little time to think of those about us or to appreciate what others are doing for us. For this reason, it is especially pleasing when some person does recognize one's efforts and takes the time to commend them.

Such an instance occurred in our office a few days ago when a resolution was received by our parent publication, the Railway Age, from the National Advisory Council of the Railway Employees and Taxpayers' Associations, expressing its "desire to record its appreciation of the assistance rendered" by this publication in the "dissemination of information tending towards the removal of the present disparity which exists between competitive methods of transportation" and recognizing that "the removal of the disparity will bring about an equality of regulation and taxation which will greatly benefit railway employees as well as the railroad companies."

This resolution is especially pleasing to us because the National Advisory Council is an organization of representatives of 26 different state organizations enrolling as members some two million railway employees and their neighbors who are interested in securing fair treatment for the railways.

As you have noted, we endeavor to so edit Railway Engineering and Maintenance as to present the latest in methods and materials that will be of interest and help to you in the conduct of your daily work. Supplementing this, and in keeping with the practice referred to in the resolution mentioned above, we also endeavor to bring to you in a leading editorial each month information bearing on some broader phase of the railway problem which you may disseminate among those of your neighbors and associates who, less thoroughly informed, might otherwise act contrary to the interests of the industry on which you and I are dependent for our livelihood. Is this practice helpful to you?

Yours sincerely,

Elmer T. Howson

ETH*JC

Editor

MEMBER: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

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**BETHLEHEM HEAT-TREATED RAIL CROSSINGS**

# Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

## NOVEMBER, 1933



**Editorials** - - - - - - - - - - - - 535
Recovery—Deficiencies—Loose Bolts

**A Million-Ton Rail Order** - - - - - - - - - - 538
Railways will receive 844,525 tons of rails at a price of $36.375 on orders pooled with Co-ordinator Eastman

**Dowels and Regrouting Stop Wall Bulging** - - - - - 543
Sliding of the courses of an ashlar stone masonry wall was stopped by means of dowels and effective use of grout

**What Kind of a Deep-Well Pump?** - - - - - - - - 545
A. R. E. A. committee reviews some of the most recent developments in pumping equipment designed for this type of service

**Replace Corroded Cover Plates** - - - - - - - - 546
Lapping plates over joints in plates next below provides effective splices at points where old plates were cut for removal

**Ann Arbor Devises Safety Contest** - - - - - - - - 547
Cartoonist-trackman provides interesting and instructive puzzle picture that calls attention to many careless and slovenly practices

**Rail Joints and Their Maintenance** - - - - - - - - 548
William E. Gadd discusses various practices and stresses the importance of proper application and upkeep

**Raise Freight House Roof with Jacks** - - - - - - - - 550
Gulf, Mobile & Northern employs interesting method in adding second story to brick and concrete structure at Jackson, Miss.

**Ballast Cleaner Used on Pennsylvania** - - - - - - - 551
Cleaning of five miles of track a day is the performance record secured with the Fairmont machine on the Central region

**Why Do Bolts Get Loose?** - - - - - - - - - 552
C. H. R. Howe gives detailed discussion supplementing the answers to the question appearing on pages 559 and 560 of this issue

**Drive Ties to Stabilize Soft Roadbed** - - - - - - - 553
Lines of ties driven by a hammer mounted on a caterpillar tractor on each side of the track reduce amount of surfacing required

**What's the Answer?** - - - - - - - - - - - 554

**New and Improved Devices** - - - - - - - - - 561

**News of the Month** - - - - - - - - - - 563



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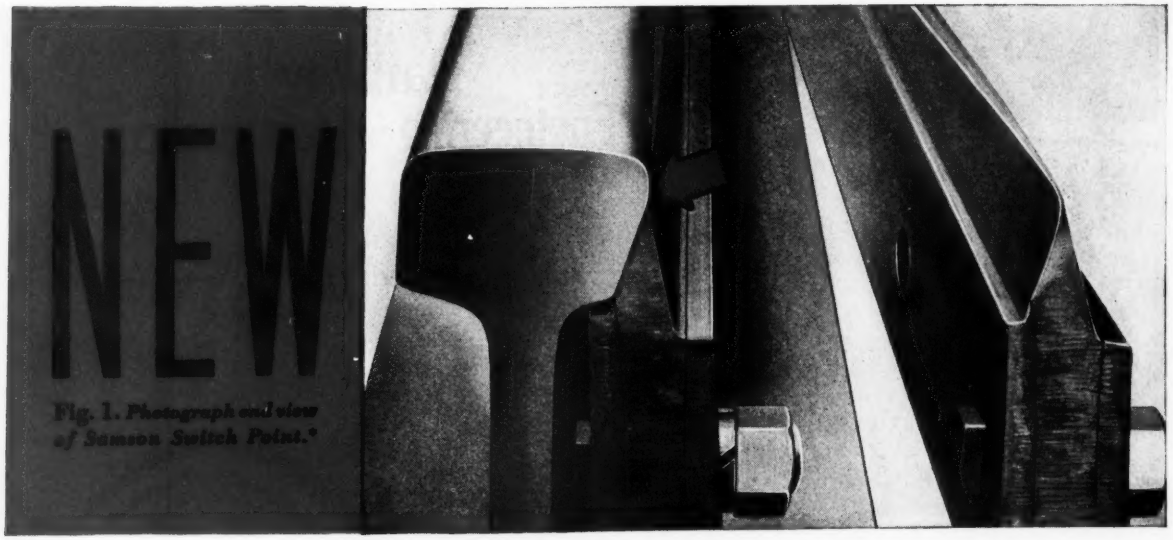


Fig. 1. Photograph and view of Samson Switch Point.*

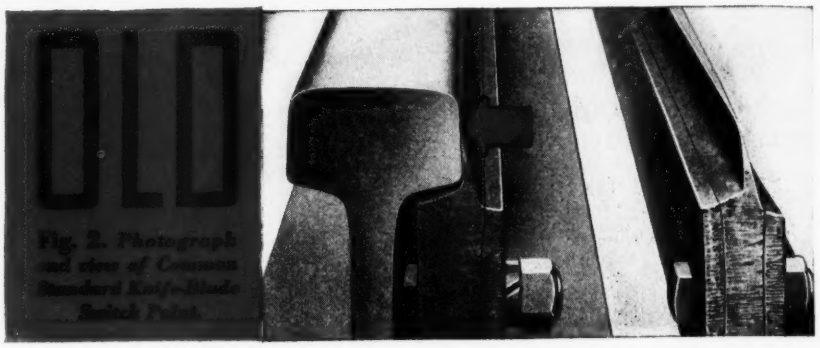


Fig. 2. Photograph and view of Common Standard Knife-Blade Switch Point.

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Railway Engineering and Maintenance

# RECOVERY

### Maintenance Outlook Is Improving

"AS business continues to improve, as I believe it will, the increased earnings resulting therefrom will enable the carriers to increase their maintenance expenditures and soon regain the physical condition in which they were in 1929." This statement, which was made within the last few days by Daniel Willard, president of the Baltimore & Ohio, is of special interest at this time when there are some who see new cause for pessimism and others among railway officers who are refusing to admit that there is under-maintenance today. Because of this difference of opinion and the very direct bearing that developments of the near future will have on maintenance activities, it is important that every officer in this branch of railway service know all the facts.

### Carloadings and Earnings

Turning first to traffic, and to carloadings as the index of traffic, it will be recalled that carloadings turned downward in the fall of 1929 and declined steadily until August, 1932, when they were only 48 per cent of those for the corresponding month of 1925-29. Since that time there has been an upturn, broken at times by such unfavorable developments as the banking moratorium last March, but upward, nevertheless, until in the second week in May of this year the number of cars loaded exceeded that for the same week for the preceding year and this favorable comparison has prevailed without a single exception in the 23 weeks that have since intervened, the total for the week ending October 21, the latest for which figures are available, exceeding that for the corresponding week for the previous year by 8,497 cars. Furthermore, the total carloadings since May 13 of this year are more than 1,800,000 larger than in the same period of 1932, with the result that they have not only overcome the decrease of more than 1,300,000 cars loaded in the early weeks of the year but have accumulated an increase for the 41 weeks of the year to date of nearly 500,000 cars.

This change in the trend of traffic has exerted a corresponding influence on the trend of earnings. In 1932 the roads earned a total net operating income of only $334,324,999, an amount that fell short of meeting their fixed charges by $153,308,487. This decline continued through the early months of this year until net operating income fell to a new low of $9,854,884 in March. With the increase in traffic, however, net operating income increased to $59,483,185 in June, to $64,307,068 in July and to $60,978,216 in August, while such figures as are available at this time indicate that the total for September will approximate or slightly exceed the August figure. On the basis of such returns, it is estimated that the deficit in fixed charges of more than $120,000,000 that accumulated in the first five months of this year will be largely if not entirely wiped out by the end of the year.

### Increase in Expenditures

With such an improvement in traffic and earnings, it is to be expected that there would be an increase in expenditures for maintenance of way and other purposes and this is occurring. Take purchases, for illustration. Whereas as recently as last April purchases totaled only about $29,000,000 and they approximated only $33,000,000 in June, they amounted to $39,000,000 in July and to an estimated total of $45,000,000 in August. In other words, August purchases were more than 50 per cent larger than those only four months previous. Furthermore, in every month since April of this year purchases have been larger than in the corresponding month of last year, while in August they were the largest for 18 months.

Referring more specifically to maintenance of way activities, where the decline in expenditures has been greater in proportion than in operating expenditures as a whole, the same change in trend is evident. Starting with November, 1929, expenditures for maintenance of way were less than those for the same month of the previous year for every month until July of this year. In this latter month this trend, which had continued unbroken for more than 4½ years, changed and an increase was recorded which has continued to date. In August, the latest month for which complete figures are available, the expenditures were more than 10 per cent larger than in August, 1932.

Turning to labor, maintenance of way employment reached a minimum of 175,453 persons in March of this year, this comparing with a maximum force of 487,429 in July, 1927. Each month since last March has shown an increase, however, the total for September being 224,876, an increase of 49,423 or 28 per cent. It is worthy of note also that in this latter month, the total number of maintenance of way employees exceeded that for the corresponding period in the preceding year for the second consecutive month after 56 months of continuous unbroken declines.

Indicative of the increased activity that is ahead is the order for 1,085,000 tons of rails and fastenings negotiated by the federal co-ordinator, as described on page 538 of this issue. This order calls for more than four

times the tonnage ordered in 1932. At the same time, it is less than half a normal year's purchases prior to the depression. With an accumulation of more than 3,000,000 tons of deferred replacements, it is evident that this order, large as it is, is but the forerunner of others that will follow as funds become available. And so it will be with ties, the renewal of more than 75,000,000 of which is overdue. It applies equally to structures, where painting is little more than a memory, and to almost all normal maintenance activities. It extends also to the equipment used in maintenance operations, as illustrated by the survey of motor car obsolescence presented in the August issue, wherein it was shown that less than 20 per cent of the cars in service today are less than 5 years old and one-third are more than 10 years old. The accumulation of deferred expenditures that are required to bring the roadway and structures back to the condition in which they entered the depression in 1929 is estimated to total more than $700,000,000.

### Roadway First

It is significant that, contrary to the practice at the end of previous depressions, rehabilitation is now being undertaken first in roadway rather than in equipment. This is due, in part, to the fact that the needs here are more readily discernible and, in part, also to the further fact that added employment may be stimulated more quickly. Thus, estimates show that the immediate operation of laying the new rail in track and of relaying in other tracks the rail released by that to be received from the mills will provide employment for at least 20,000 men for four months—entirely aside from the forces that will be required to surface these tracks and otherwise protect the new rail as soon as the season permits, and ignoring also the far larger number of men that will be employed in the steel mills and in the preparation and transportation of the raw materials entering into the rails and fastenings.

While business in general has shown some recession within recent weeks from the inflationary peak of midsummer, it is still well above the level of a year ago. In the meantime, the accumulation of deferred maintenance has increased markedly until there is today pressing for attention work involving more than an entire normal year's expenditures. With a world-wide improvement taking place in business, and with railway traffic and earnings definitely on the upgrade, it is the part of prudence for forehanded maintenance officers to give intimate attention to the needs of their properties in order that they can determine those which require first attention.

In this connection, they cannot afford to overlook the fact that the railways are now facing for the first time competition that is making serious inroads on their business and that if these inroads are to be arrested and overcome, it will be through the inauguration by the railways of services that they have not heretofore offered and that will equal and better the services of competing transportation agencies that have lured so much traffic from the railways. This will require many revisions in railway service. It will also require many changes in facilities and higher standards of maintenance than prevail in many places today.

As the railways emerge from the depression, they are facing a new era which will call for greatly increased activity and more exacting service. Maintenance forces share responsibility in meeting this competition, and this responsibility also comprises an opportunity.

## DEFICIENCIES

### In Maintenance Must Be Made Good

NO period within the memory of any man now living, not excepting the years of the World War, has produced such profound changes in established relationships or called for such marked readjustments in thinking as the depression that was launched with the panic of October, 1929, and nowhere has this been more pronounced than in the maintenance of railway tracks and structures. Although maintenance officers were inclined to view with grave alarm the cuts that were made in their budgets in 1930, the actual reduction in maintenance work for that year amounted to only about 17 per cent of the average for the previous five years. When, however, in 1931, they were faced with reductions in appropriations that brought their operations to levels far below those of any year since 1921, their troubles in 1930 paled to insignificance. But after being thoroughly convinced that the expenditures in 1931 represented the absolute minimum, maintenance officers were again forced to recast their ideas in 1932 by reductions so drastic that operations during all of that year and the first half of this year have been conducted on a scale that would have seemed absolutely out of the question back in 1929.

But even more remarkable than all this is the attitude now manifested by many maintenance men with respect to the condition of their tracks and structures, indicating a state of mind that might be designated as a "depression complex." For, in the majority of cases where the question of deferred maintenance has been raised, the replies indicate that maintenance officers have become so accustomed to think in depression terms that they now refrain from any direct comparisons of the present condition of the property with the high standards of maintenance that prevailed in 1929. What are the real facts?

A careful analysis of the expenditures for maintenance of way and structures over a period of nine years leads to the conclusion that the deficiency in expenditures for maintenance of way and structures by the end of 1933 will amount to at least $700,000,000. This figure is arrived at after taking into consideration the reductions in operating charges that are to be expected with a curtailment in improvement work, as well as the reductions in renewals that follow declines in traffic, and the reductions in the costs of labor and of materials that have occurred since 1930. It is believed, therefore, to be a conservative figure. It is further estimated that the deficiency in rail renewals will total about 3,400,000 tons and that tie renewals have been inadequate to the extent of from 80 to 90 million ties. Altogether, it is estimated that the maintenance of tracks and roadway alone is deficient to the extent of about $540,000,000, while it will require the expenditure of around $130,000,000 to restore tunnels, bridges, buildings, water stations and other structures to the physical condition that prevailed in 1929, and an out-

lay of approximately $30,000,000 will be needed to overcome the deferred maintenance in signaling and other miscellaneous facilities, the upkeep of which is included in the total expenditures for maintenance of way and structures.

The primary reason for the disparity between these figures and the statements made by many maintenance officers with respect to the condition of the properties under their charge is that most men have become accustomed to thinking in terms of the bare requirements for keeping their properties in a safe and usable condition, rather than in terms of what is needed to maintain a normal state of repair. Owing to the high standard of physical condition that prevailed in 1929, it has been possible for the properties to suffer appreciable neglect of upkeep without any noticeable reduction in their usefulness or safety. Nevertheless, the normal deterioration has continued and this has given rise to the need of replacement or repair work which must eventually be done.

It goes almost without saying that the depression has taught many lessons in economy. Pressure of necessity has forced the abandonment of practices that prevailed through force of precedent years after they had become obsolete. Consequently, it is to be expected that many items of expense will never attain the levels that prevailed in the Twenties because of such improvements in practice. But regardless of this, there is no way in which to avoid such eventualities as the replacement of worn rail and decayed ties, the repair and replacement of roofs, the painting of bridges and buildings, the renewal of ballast and the multitude of other maintenance operations that have been left undone simply because they could be carried over. It may, of course, be possible to keep the tracks and structures in a condition to handle the present volume of traffic with expenditures for maintenance only moderately exceeding those that have prevailed during the last two years. But there is no way of avoiding the eventual expenditure of vastly greater sums to overcome the enormous accumulation of deferred maintenance.

# LOOSE BOLTS

### Will Increase Rail Damage Markedly

MARKED advances have been made in materials and methods employed in maintenance. In some instances what were formerly considered basic principles have been superseded or discarded. Others remain but have assumed relatively greater importance. Track bolts fall into the latter category. Since joint fastenings were first applied to hold the rail ends in vertical and horizontal alinement, the importance of tight bolts has been recognized. As rail sections and joint fastenings have increased in size and cost, as cars and locomotives have grown heavier and as train speeds have become higher, the importance of proper bolt tension has likewise increased on the score of physical need as well as of both direct and collateral costs.

It is not debatable that rail can be damaged through neglect to keep bolts tight. Opinion is not unanimous, however, on what constitutes the proper degree of tightness. Considerable light has been thrown on this question by the investigations of the Special Committee on Stresses in Track of the American Railway Engineering Association, which found that a minimum bolt tension of 5,000 lb. for symmetrical bars and of 10,000 lb. for angle bars may be expected to give satisfactory results, with the upper limit of useful tension 20,000 lb. for both types.

On some roads it has been the practice to tighten the bolts until the tension rises to 40,000 lb. and in some cases to 50,000 lb. It is becoming more generally accepted, however, that no useful purpose is served by these excessive tensions and that undesirable results may ensue. For instance, they are likely to "freeze" the joints, thus preventing the movement of the rail in expansion and contraction.

Many factors contribute to loosen bolts, once they have been properly tightened. Back of this, however, is the undeniable fact that proper attention is not always given to the important matter of properly tightening the bolts when the rail is first laid. There are few trackmen who do not appreciate the need for proper tightening at this time, but too frequently over-emphasis is placed on the matter of production in laying rail, with the result that some of the essentials of good workmanship are neglected. Even where close attention has been given to this feature of the rail-laying operation, it is invariably necessary later, if the joints are to be maintained to maximum efficiency, to tighten the bolts a second and often a third time before all of the parts of the joint assembly are properly seated.

At about this point, wear of the rail ends and of the constituent members of the joint assembly commences, and the necessity for maintenance begins. As wheels pass over the joints, the stiffness of the rail and of the joint bars differs and they do not deflect as a unit, with the result that there is a relative movement between them which produces wear on the surfaces that are in contact. This wear is slow at first, but as it increases, the relative movement of the parts increases and the rate of wear likewise increases. Obviously, this tends to reduce bolt tension, and in time will cause the bolts to become loose.

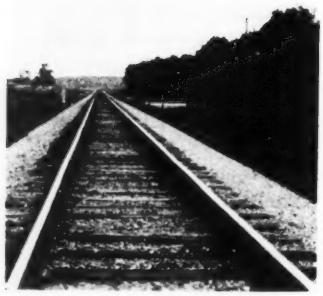
Properly designed joint bars provide for taking up a considerable amount of wear through the simple expedient of tightening the bolts when the tension is reduced. Up to a certain point, this take up is obtained automatically by the spring in the joint bar so long as the bolts remain tight, and this action can be augmented by the use of spring washers of proper design and capacity.

If the bolts are allowed to remain loose, a long train of damage results to the rail, the joint bars, the ties and sometimes to the roadbed, which it is unnecessary to enumerate since they are known to every trackman. While some of the causes of loose bolts are beyond the control of the section and supervisory forces, they must assume responsibility for the remainder. Careless and deficient practices with respect to joint maintenance are the most frequent causes of loose bolts and, therefore, of much of the damage that occurs to rail and joints.

Local maintenance officers have few tasks more important than the conservation of their rail, this being particularly true at this period when deferred maintenance has grown to such magnitude. The manner in which they meet this responsibility is a clear indication of their ability, while the standard to which they maintain their joints is an index of their attention to their routine work.

# A Million-Ton Rail Order

## Railways to receive 844,525 tons of rails at a price of $36.375 on orders pooled with Co-ordinator Eastman



ON October 30, at a conference held at the White House, officers of the four companies that manufacture rails, agreed to a figure of $36.375 proposed by President Roosevelt as the price to be paid for 844,525 tons of rails, that are to be bought on orders pooled with Joseph B. Eastman, Federal Co-ordinator of Transportation. This action marks the successful outcome of a plan set on foot by the co-ordinator at the instance of the President on September 8, and which in addition to the rails, provides also for the purchase of 245,221 tons of track accessories. The plan is of vital interest alike to the railways, the steel mills and the Federal Government.

To the railroads, the purchase of the rail means that they can make an effective start in rail renewals that have been curtailed so drastically during the last four years as to result in an estimated deficiency of 3,400,000 tons. For the steel companies, it will provide about four months' work for rail mills that have been idle about 85 per cent of the time during the last two years. But in addition, it provides a definite measure for overcoming unemployment which has been the outstanding concern of President Roosevelt's administration since the day he took office.

It is estimated that the laying of the new rail will provide employment for some 9,000 maintenance of way and train-service employees over a period of three months, while the laying of usable relayers and the necessary programs of surfacing to protect the new rail from injury will increase the employment to some 20,000 men for an equivalent period. These figures take no account of the pick-up in the employment of train-service employees that will be involved in the transportation of ore, coal, coke, limestone and slag incidental to the production of this quantity of new steel, nor of the much larger number of men who will be put to work in the steel mills, coal and iron mines, coke ovens, quarries and the plants that produce accessories. It is estimated that the rail order will keep the rail mills busy for at least four months.

### Outline of the Plan

Briefly, the plan provides for the collective purchase for some 47 railways of individual orders pooled through the office of Mr. Eastman at a substantial reduction from the prices that have prevailed for several years, with the option of loans from the Public Works Administration at terms much more favorable than those at which earlier loans to the railways were made by the Reconstruction Finance Corporation. The project was set on foot on September 8, with the announcement that the President had been interesting himself in the possibility of making loans to the railroads for the purchase of rails from the public works fund, provided the price of rails could be reduced, and that he had discussed the matter with Co-ordinator Eastman and representatives of the railroads. However, because of the time required for the railways to study their requirements and the need for extended negotiations regarding the prices, as well as other problems that have been presented, it has taken nearly two months to bring the project to a successful conclusion.

### Purpose of the Plan

The present plan is one result of efforts which have been going on all summer to induce the railroads to take advantage of the opportunity offered for loans from the Public Works Administration, following the passage of the National Industrial Recovery Act in June. Under this act the President is authorized to "aid in the financing of such railroad maintenance and equipment as may be approved by the Interstate Commerce Commission as desirable for the improvement of transportation facilities."

One of Co-ordinator Eastman's first statements to the railroads when he assumed office, after stating that the President had decided that the railroads were not to be dealt with under the NRA, was that this "makes it all the more important that the railroads play their proper part in the program of national recovery" and urged them "to use every available dollar, as traffic and revenue increase, to put more men to work." "There is so much deferred maintenance and other work which sorely needs to be done," he said, "that this will not only help the country but be the soundest of economy." He also called attention to the fact that money can now be borrowed on favorable terms from the Public Works Administration for railroad equipment and maintenance but that thus far no railroad had availed itself of this opportunity. The railroads will not play their proper part, he said, if they neglect these opportunities.

In some other quarters efforts were being made to persuade the railroads to borrow money from the fund for the purchase of new equipment but the roads displayed comparatively little interest. Later, following the campaign of the National Recovery Administration to increase employment and wages with a view to increasing the purchasing power of consumers, attention began to be called in Washington to the fact that there had been an even greater decrease in the volume of business and employment in the so-called "capital goods" industries than in those producing "consumer's goods," and the planners in the government's new organizations began to cast about for ways of stimulating such industries.

While the primary purpose, according to Mr. Eastman,

arises from the government's desire in the existing emergency to stimulate business and employment, particularly in the steel industry but also in the field of railroad maintenance, undoubtedly a secondary purpose and the effect of the plan, at least temporarily, is to introduce a measure of competition into the fixing of rail prices, which have been maintained on a uniform basis for many years and which, from 1932 to 1933, had remained static at $43 a ton, while the prices of many other steel products were declining. In 1932, there was a uniform reduction to $40 a ton but in the circumstances it was not sufficient to induce any large orders by the railroads.

### Possibilities of Collective Buying

One feature of the plan may be a desire to produce an object lesson as to the possibilities of collective buying by the railroads, although this has not been mentioned. Co-ordinator Eastman, whose opportunities for suggesting economies to the railroads have been greatly curtailed by the labor restrictions of the Emergency Transportation Act, is devoting special attention to possibilities of economies without reducing employment.

Whatever may be the effect of the precedent of this reduction on the future course of steel rail prices, the present project has been handled on the basis of an emergency plan to promote employment. In a letter to the executives of the steel companies, Mr. Eastman pointed out that the terms offered by the Public Works Administration for the loans were far more favorable than can be obtained commercially at the present time, "and are only offered because of the government's desire in the existing emergency to stimulate business and employment, particularly in the steel industry." "The government believes," he said, "that the contribution which it is thus making to the common good in the emergency should be met in like spirit by the industries affected, and unless such a spirit is manifested in the base prices submitted, there can be no assurance that the loans will be made. It is my belief that you will arrive at your prices in all good faith and in full realization of the emergency by which the country is confronted and of the extent to which your action may contribute to the relief of that emergency." At the same time, however, he presented arguments indicating a belief that a greater reduction in rail prices should have been made before.

### Railroads Asked to State Requirements

Following a conference with the President on September 8, Mr. Eastman was asked to obtain figures from the railroads as to the quantity of rail they would be willing to take, contingent upon government loans and a substantial reduction in price, so that the prospect of large orders could be held before the steel companies in subsequent discussions as to the price. Mr. Eastman then asked the Association of Railway Executives to assist him in collecting the information from the railroads.

The next step was a conference held by the President with the executive officers of the four companies that manufacture heavy steel rails. This meeting, which was held on September 25, was attended by Mr. Eastman and by Myron C. Taylor, chairman of the United States Steel Corporation, Eugene G. Grace, president of the Bethlehem Steel Company, and L. E. Block, chairman of the Inland Steel Company. Arthur Roeder, receiver of the Colorado Fuel & Iron Company, was also invited but was not present. At this conference Mr. Eastman submitted tentative commitments from the railroads for between 600,000 and 700,000 tons of rails and it was later announced from the White House that the officers of the four companies manufacturing heavy steel rails agreed to submit independent competitive bids if the railroads would signify willingness to place substantial orders. On October 3, Mr. Eastman requested them to submit such bids, suggesting a price of $35 or less.

**Tentative Commitments**

| Name of Railroad | Rail Tons | Fastenings Tons |
|---|---|---|
| Atchison, Topeka & Santa Fe | 50,000 | 15,000 |
| Atlantic Coast Line | 10,000 | 3,000 |
| Baltimore & Ohio, Central of N. J.-Reading-Alton | 50,000 | 15,000 |
| Bangor & Aroostook | 3,500 | 1,050 |
| Boston & Maine—Maine Central | 40,000 | 12,000 |
| Central of Georgia | 3,000 | 900 |
| Central Vermont | 5,000 | 1,500 |
| Chicago & Illinois Midland | 1,750 | 525 |
| Chicago & North Western | 65,000 | 14,364 |
| Chicago & Western Indiana-Belt Ry. of Chicago | 3,000 | 900 |
| Chicago, Burlington & Quincy | 25,000 | 3,000 |
| Chicago Great Western | 12,000 | 3,600 |
| Chicago, Indianapolis & Louisville | 3,000 | 900 |
| Chicago, Milwaukee, St. Paul & Pacific | 50,000 | 15,000 |
| Chicago Rock Island & Pacific | 20,000 | 6,000 |
| Clinchfield | 3,000 | 900 |
| Delaware & Hudson | 5,000 | 1,500 |
| Delaware, Lackawanna & Western | 12,000 | 3,600 |
| Denver & Rio Grande Western | 10,000 | 3,000 |
| Erie | 30,000 | 9,000 |
| Gulf, Mobile & Northern | 5,000 | 1,500 |
| Illinois Central | 20,000 | 6,000 |
| Louisiana & Arkansas | 12,000 | 3,600 |
| Lehigh & New England | 3,285 | 985 |
| Louisville & Nashville | 25,000 | 7,500 |
| Minneapolis, St. Paul & Sault Ste. Marie | 7,500 | 2,250 |
| Missouri-Kansas-Texas | 4,500 | 1,350 |
| Mobile & Ohio | 3,000 | 900 |
| Missouri Pacific-Gulf Coast Lines-Intern' G. N. | 25,000 | 7,500 |
| New York, New Haven & Hartford | 20,000 | 7,500 |
| Nashville, Chattanooga & St. Louis | 3,490 | 1,047 |
| Northern Pacific | 10,000 | 3,000 |
| Norfolk & Western | 10,000 | 3,000 |
| Pennsylvania | 100,000 | 30,000 |
| Richmond, Fredericksburg & Potomac | 500 | 150 |
| St. Louis-San Francisco | 26,000 | 7,800 |
| Seaboard Air Line | 17,000 | 5,100 |
| St. Louis Southwestern | 9,000 | 2,700 |
| Southern | 50,000 | 15,000 |
| Southern Pacific | 25,000 | 7,500 |
| Tennessee Central | 2,500 | 750 |
| Toledo, Peoria & Western | 5,000 | 1,500 |
| Texas & Pacific | 500 | 150 |
| Union Pacific | 25,000 | 7,500 |
| Western Maryland | 4,000 | 1,200 |
| Western Pacific | 20,000 | 6,000 |
| Wabash | 10,000 | 3,000 |
| Total | 844,525 | 245,221 |
| Grand Total | | 1,089,746 |

Many of the railroads indicated an intention to participate in the plan shortly after it was announced, and after the position of the steel executives at the White House conference had been made known, a number of other roads signified their intention of taking advantage of the opportunity for reduced prices. Many of the railroads, however, have indicated an intention of buying the rails, contingent upon a reduced price, without borrowing from the government, and some roads, notably the Pennsylvania which is willing to purchase 100,000 tons, did not stipulate any reduction in price. The Pennsylvania also indicated its desire to place its own orders. Some railroads made it a condition that the base price should not exceed $35 a ton. In the case of 452,785 tons out of the 844,525, the railroads made their commitments contingent upon government loans, and it was stated that this condition might be attached as to 50,000 more tons.

By October 4, returns had been received from 47 railways making reservations totaling 844,525 tons of rails and 245,221 tons of track fastenings—the tonnage by individual railways is given in the table. With these data in hand, Mr. Eastman addressed a letter to the executives of the four steel companies informing them of the prospective rail tonnage, adding that it was quite possible that the amounts would exceed these figures. He also asked them to inform him by letter, as soon as possible, what the base price (f.o.b. mill, or, in the case of rails carried by water from any Atlantic coast or Gulf port to any Gulf or Pacific coast port, c.i.f., the port of destination) of his company, including any subsidiary companies, would be for standard rails of more than 60 lb. per yard in the event of the purchases mentioned. The letters would be treated as confidential until all were in, he said.

In commenting on the list of reservations tendered, he stated that "the tonnage of fastenings has been estimated at 30 per cent of the rail tonnage, except where a higher figure was specified. My understanding is that the railroads are prepared to take early delivery, except that the Southern Pacific will want a part of its order delivered in 1934, the Lackawanna will want 2,000 tons in 1933 and 10,000 tons in 1934, the Western Maryland will want 2,000 tons in 1933 and 2,000 tons in 1934, and the Northern Pacific will want 5,000 tons in 1933 and 5,000 in 1934."

### Limit Weights of Rails to Be Rolled

Mr. Eastman's letter outlined the terms under which the rails would be bought, with the exception of the price, which has not yet been determined. "The orders," he said, "are contingent upon loans from the Public Works Administration on the basis of a note from the borrower, due in 10 years, bearing interest at the rate of 4 per cent, no interest to be charged for the first year, and the borrower to have the option of paying off the note in part or in full at any time. These are very favorable terms, far more favorable than can be obtained commercially at the present time, and are only offered because of the government's desire in the existing emergency to stimulate business and employment, particularly in the steel industry. The purpose of the loans must be approved by the Interstate Commerce Commission before they can be made." He stated, also, that the sections to be rolled will be confined so far as possible to five standard weights. A part of his letter follows:

The Railroad Rail committee, composed of representatives of the American Railway Engineering Association and of Division IV of the American Railway Association, has under consideration the establishment of five standard weights for T-rails, each to be rolled in only one section, and I am informed that agreement has been reached upon the two most important of the proposed standards, namely, the 112-lb. and 131-lb. weights. While I do not understand that these standards have yet been adopted by the railroad industry, I shall impress upon the purchasing railroads the desirability of submitting specifications in accordance, so far as possible, with these standards and with standard specifications of rail quality. It will be understood, however, that if specifications are later submitted which, in customary trade practice have called for extras or deductions over or under the base price, such extras or deductions will be those which have been approved by the board of directors of the American Iron and Steel Institute under the code of fair competition of the iron and steel industry.

At the present time I am not asking for prices on the fastenings, because it is my understanding that whereas only the four companies which I am now addressing, or subsidiaries thereof, manufacture standard T-rails of more than 60 lb. per yard, rail fastenings are sold by numerous other concerns. Inasmuch as there are some uncertainties, with respect to the purchase of rails, it has seemed advisable to leave the matter of the fastenings in abeyance until the rail questions have been determined. Thereafter, all concerns selling fastenings will be given an opportunity to submit prices therefor.

### Standard Drilling Recommended

Because of the active comment on standardization that has been aroused by references to the subject by the co-ordinator, it is pertinent to direct attention to a statement which he issued on October 14, relative to rail joints, calling attention to the fact that the standardization of rail joints and other accessorries presents a complicated patent situation.

In view of the present situation in regard to proposed purchases of rails and rail joints, it seems advisable to defer recommendations by the co-ordinator on the adoption of a single cross-section of joint bar, but to secure immediate adoption of the Rail committee of standards for hole diameters and spacing in rail ends. On present information, I believe that the number of existing different types of joint bars applicable to 131-lb. and 112-lb. rails is small, and that delay in placing orders for joint bars will be avoided if no restriction is placed on the selection of bars to be used with rails now proposed to be purchased. It is to be understood, however, that recommendations may be made in the future looking toward further reduction in the variety of joint bars. Such recommendations would be determined largely by the action of the American Railway Association in respect to standards developed by the Rail committeee.

I now recommend the immediate adoption by all railroads of the following standards for drilling the ends of 131-lb. and 112-lb. rail:

1. Holes to be 1⅛ in. in diameter.
2. Center of first hole to be 2½ in. from end of rail; center of second hole to be 6½ in. from center of first hole; if third hole is used, its center to be 6½ in. from center of second hole.
3. Height from base of rail to horizontal center line of holes to be (a) 3 3/32 in. for the 131-lb. rail (b) 2⅞ in. for the 112-lb. rail.

### Pressure Brought to Lower Prices

Mr. Eastman's letter discussed the question of price at some length:

It is my understanding that under the code of fair competition, the base price named by any company will ultimately be known and may be met by any other company. I shall assume, therefore, unless advised to the contrary, that the lowest base price submitted in response to my request will become the prevailing base price for all companies. In accordance with the understanding reached at the President's conference, and proceeding upon this assumption, I shall, upon receipt of the prices, undertake the allocation of the orders among the steel companies. This will be done after consultation with the railroads concerned and with the object of obtaining the rails at the point of use at the lowest total cost, including transportation. Where costs are equal, preference will be given, as between two or more steel companies, to the one which submitted the lowest base price in response to my request.

As you know, it was the understanding at the President's conference that base prices would be submitted, in response to my request, by the steel companies independently of each other and without collusion or consultation. In this connection there are certain circumstances which I believe should be called to your attention. These are as follows:

The commitments of the railroad companies for orders are very largely upon condition that there shall be a reduction in the base price below the now prevailing price, which is understood to be $40 per ton f.o.b. mill. The only exception is the Pennsylvania which is willing to purchase 100,000 tons but desires to place its own orders and does not stipulate a price reduction. Certain railroads, contemplating important orders, make it a condition that the base price shall not exceed $35 per ton.

In this connection, permit me to make certain personal observations. The fact is that for 11 years, 1922-1932, the base price of steel rails in the country remained static at $43 per ton, while the prices of most other steel products were steadily declining. Whenever the railroads found it necessary under the Clayton Anti-trust Act to secure competitive bids, the base price uniformly submitted by all companies was always $43. In 1932 there was a reduction of about 7 per cent to a figure, likewise uniform, of $40 per ton. Since 1926, also, an international agreement among steel-rail producers has prevented the importation of steel rails into this country. Prevailing prices of steel rails in other countries, however, have declined more in line with the prices of other steel products. While certain improvements in the specifications of steel rails have been made by the railroads since 1922, they are not changes which have added very materially to costs; and what small increase in cost there may have been on this account has been more than offset by technological improvements in the production of steel all the way from the mine to the mill.

While the code of fair competition of the iron and steel industry has added somewhat to the labor costs prevailing immediately prior to the code, I am not informed that such costs now exceed those which prevailed prior to the depression. Moreover, the steel companies have now the prospect of large, concentrated orders which can be produced under favorable conditions, and the probability of a material reduction in the number of separate rail weights and cross-sections.

These are a few of the salient facts. The available information warrants a conclusion that the base prices to be submitted should be below rather than above $35 per ton. If this conclusion is challenged, I suggest that the way to clear up the point is to afford government accountants an opportunity to examine the books and records of the steel companies.

### Rail Price Long a Matter of Controversy

The question of steel rail prices had been brought into public controversy, in which governmental agencies took an active part, during the World War period, when prices rose from $28 a ton for Bessemer rail and $30 for open-hearth rail to as much as $55 and $57. In March, 1919, the Industrial Board of the Department of Commerce named $45 and $47 as fair prices, but the Navy department, which had occasion to place a small order for rails, rejected bids submitted by the steel companies at this figure and later the Railroad Administration, then in charge of the operations of the railroads, also objected to the price and asked competitive bids on 200,000 tons. Six companies submitted uniform bids at the prices which had been named by the government board, and a seventh asked $55 and $57, whereupon orders were placed, with "emphatic disapproval of the prices and the manner in which they have been established," expressed in a statement issued by Walker D. Hines, director general of railroads, who said that the action of the steel companies had been taken under the leadership of the United States Steel Corporation. The Railroad Administration had attempted to obtain an agreement on a price of $41.37. Later in the year the Railroad Administration again asked bids on 100,000 tons and the same prices were submitted. During the depression that followed the war, the price fell to $40 for open-hearth rail but on January 1, 1923, it was increased to $43 where it remained until late in 1932.

On October 20, 1932, after several months of informal discussions in railroad and steel circles, Myron C. Taylor, chairman of the United States Steel Corporation, announced a reduction of $3 a ton to $40, in an effort to stimulate purchases after rail orders had fallen from 2,722,138 tons rolled in 1929 to less than 200,000 tons in the first half of 1932. However the total production for the year was only 402,566 tons and it was only 97,954 tons in the first half of 1933.

### Mills Tender a Price of $37.75

The replies from the manufacturers to Mr. Eastman's suggestion that the price of rails should be "below rather than above $35" were long in forthcoming, but in the meantime there were manifestations that the suggestion did not meet with favor. The trade papers serving the steel industry were vociferous in the denunciation of what they deemed an unwarranted reduction in the price. Attention was directed to the exacting requirements of rail manufacture and the increase in manufacturing costs that were brought about through the application of the NRA steel code.

Finally on October 28, officers of the four steel companies addressed letters to Mr. Eastman, quoting the uniform price of $37.75 per gross ton, f.o.b. mill, by filing lists naming this price with the American Iron and Steel Institute under the provisions of the code of fair competition agreed upon with the National Recovery Administration, effective on October 30

After consultation with the President, Mr. Eastman, on October 27, notified the companies that the government would not make loans on this basis and, asserting that the prices submitted "bear unmistakable evidence of prior consultation and collusion and absence of competition," informed them that it would not loan on a basis higher than $35 a ton unless the companies agreed to an adjustment on a basis found to be fair by the President after an examination of the books and cost records of the steel companies.

### Mr. Eastman's Reply

Mr. Eastman's reply to the steel companies was, in part as follows:

The facts that these letters bear a common date, that they name an identical price for first quality rail, f.o.b. mill, and that this price is the odd figure of $37.75 point unmistakably to the conclusion that the letters were the result of consultation and collusion. In my letter to you of October 3, I stated: "As you know, it was the understanding at the President's conference that base prices would be submitted, in response to my request, by the steel companies independently of each other and without collusion or consultation.

Clearly, what has been done is not in accord with this understanding. Moreover, there is nothing in the code of fair competition which made necessary such a deviation from the understanding. In confirmation of this statement, it is noted that the letter from the U. S. Steel Corporation concludes with the following sentence: "If any of our competitors file a lower price than the above, we will, of course, refile to meet their price."

Because of the evident consultation and collusion in arriving at the new and uniform base prices, it seems clear that these are non-competitive prices lacking the safeguard to the consumer which competition provides. Manifestly, also, the code was not intended to eliminate competition. On the contrary, it is by its own terms a "code of fair competition."

In view of these circumstances and of the past history of steel-rail prices in this country and what is known about them, I am authorized by the President to say that the federal government is unwilling to lend money to railroad companies for the purchase of steel rails at the new base prices which have been filed, without some safeguard to the consumer and to the public interest to take the place of competition. This substitute safeguard is an examination by government accountants of the books and cost records of the steel companies.

Under existing conditions and to avoid possible delay, the government is willing to lend the necessary funds without such an examination, provided the base price, f.o.b. mill, for first quality steel rail (500 gross tons or over) is made not more than $35 per gross ton of 2,240 lb., with other prices adjusted accordingly. If the steel companies are unwilling to

make this concession, then the government will lend the necessary funds only on condition that the steel companies shall file new base prices the same as those now on file but with the added stipulation that if, after government accountants have had full and free opportunity to examine the books and cost records of the steel companies, the President shall find that reductions in these prices are necessary to make them fair, the reduced prices which he then names shall be the base prices to the same extent and from the same date as if they had been originally filed.

Following the transmittal of Mr. Eastman's letter, the rail manufacturers were invited to a conference at the White House on October 30, where they explained that the recent offer of all four companies to supply steel

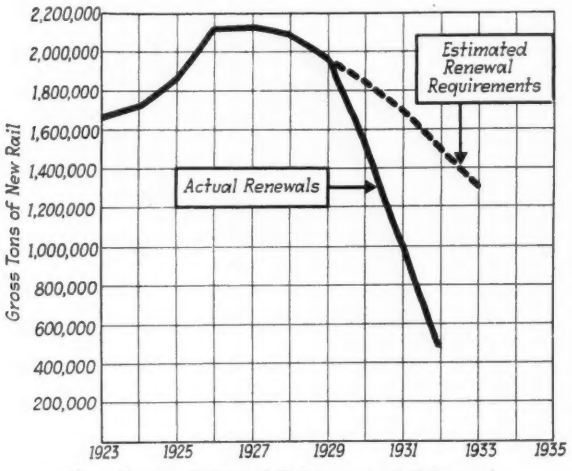



Chart Showing Estimated Deficiency in Rail Renewals

rails at the uniform price of $37.75 a ton was based on the following action, in accordance with their understanding of the provisions of the steel code; The U. S. Steel Corporation, without consultation with the other manufacturers and in conformity with the code, notified the iron and steel institute that it proposed to reduce its price for steel rails from $40 a ton to $37.75 a ton. This notice, having been given to the Institute, became public property and thereupon the other three manufacturers of steel rails reduced their price to meet the price established by the U. S. Steel Corporation.

They also maintained the position that the price of $37.75 represented to them only the cost of production plus a fair profit, while the co-ordinator of transportation stated again his belief that not more than $35 a ton would represent a fair purchase price. Following this, President Roosevelt, in the interest of getting people to work in the mills and on the tracks, proposed a price halfway between, or $36.375 a ton, and this was accepted by the manufacturers. The co-ordinator will now advise the administrator of public works of this decision and of the actual tonnage needs of the various railroads, based on the results of a recanvass of the roads. On October 31, the Great Northern tentatively committed itself to the purchase of 20,000 tons, and the Chicago & Eastern Illinois to 4,000 tons.

## Rail Replacements Sorely Needed

That the railways are sorely in need of new rails is indicated in part by the table of rail renewals given in the next column, which shows the sharp decline in rails laid in replacement since 1929. It fails to give the complete picture, however, because it does not show the low level of replacements in 1933, for which accurate and reliable data are not yet available.

The table, of course, is but an index, because a valid comparison must take into account the reduction in traffic that has occurred during this period. An approximate method is to determine the relation of the number of tons of rail laid in replacement in any year with the gross ton miles of traffic in a period of, say, seven years ending with the year of renewal, and compare this relationship with the corresponding figures for other years. This computation shows that the renewals in 1929 amounted to 233,000 tons of rail per trillion gross ton-

| Year | Gross Tons of New Rail Laid in Replacements |
|---|---|
| 1923 | 1,700,000* |
| 1924 | 1,700,000* |
| 1925 | 1,900,000* |
| 1926 | 2,100,000* |
| 1927 | 2,124,765 |
| 1928 | 2,080,277 |
| 1929 | 1,958,489 |
| 1930 | 1,517,002 |
| 1931 | 984,900 |
| 1932 | 394,000 |

(*) Estimated

miles, a figure that compares with 259,000 tons for 1928 and 278,000 tons for 1927, and indicates a declining rate of renewals—possibly the effect of improved practice in rail maintenance, for example—the building up of battered ends. Assuming that this decline in rail renewal requirements would continue through to 1934, the calculated requirements for 1930, 31, 32 and 33 are approximately 1,850,000, 1,700,000, 1,500,000 and 1,300,000 tons, respectively. Deducting from the sum of these figures, the total number of rails actually laid in the last

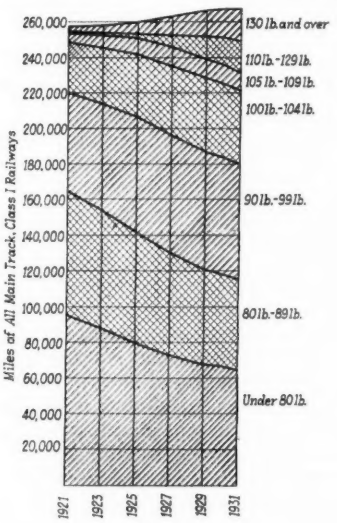



Chart Showing Trend Toward the Use of Heavier Rail Sections

3½ years we arrive at a total of about 3,400,000 as the deficiency in rail renewals at the end of 1933.

The validity of this estimate depends in some measure on the policy to be pursued by the railways in the future with respect to the relation of weights of rail to traffic carried. During the period beginning with 1920, the tonnage of rails laid in renewals was definitely influenced by the trend toward the use of heavier sections, as shown in the chart of the miles of main tracks laid with different weights of rail. Obviously, if this policy were to be abandoned, the rail requirements in the future would be less, but since it will be observed that the mileage of tracks laid with the heavier sections is still a relatively small proportion of the total mileage of important main line tracks, it would seem that the demand for replacements in heavier rails will be sustained for some time in the future.

# Dowels and Regrouting Stop Wall Bulging

**Sliding courses of high ashlar masonry structure are rebonded internally, obviating reconstruction**

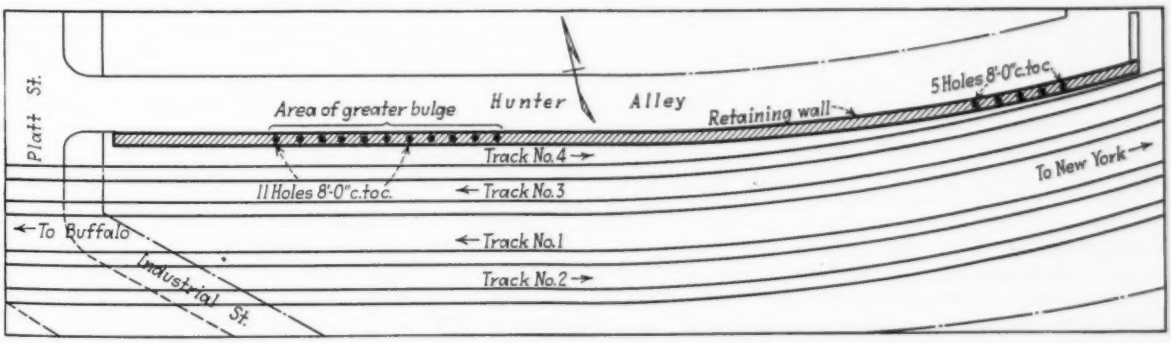
Above — Looking Along the Bulged Wall, Showing Scaffold Platform Used in Repair Work. Left —Ramming the Grout Into One of the Perforated Pipe Dowels

BY THE relatively simple and inexpensive expedient of placing vertical pipe dowels in drilled holes and by injecting cement grout internally through openings in the pipe into the open joints of a high ashlar masonry retaining wall which had begun to slip at certain lines of joints, the New York Central is stabilizing the wall and thereby avoiding its reconstruction, estimated to cost in the neighborhood of $90,000, or its reinforcement by various other methods, estimated to cost considerably more than the one adopted. The dowel and grouting work, which is estimated to cost only about $5,000 when completed, is being done at Rochester, N. Y., where the wall, about 18 ft. high above the ground level, supports the north side of a section of the four-track main-line embankment through the city.

### Upper Section Moved Out Over Joints

The wall in question is of the mass type and extends along a public alley, retaining the north side of the elevated railroad property over a distance of approximately 375 ft. within the city block immediately east of Platt street. The wall was constructed about 1881 when the tracks were elevated through the city, and about 1900 was faced with eight inches of concrete, reinforced with longitudinal rods. Until 1930, no trouble was experienced with the wall, but in that year it began to bulge at two points about 240 ft. apart, and the nearest track, the center-line of which is only 10 ft. 10 in. from the inside face of the wall, began to settle out of surface. The larger of the bulges reached a maximum of about 6 in. and extended over a distance of approximately 100 ft., while the smaller bulge amounted to only about half as much and extended over a distance of only about 50 ft. Both bulges caused concern, however, because of the height of the wall and the high-speed main-line traffic which it supports.

In investigating the cause of the bulges, a number of holes were cut through the concrete facing in the bulged areas. These disclosed a distinct line of slippage between the blocks at a height of about five feet above the alley pavement at the point of greater bulge, and a similar line of slippage between blocks, but considerably higher, at the point of smaller bulge, the entire wall above the lines of slippage having moved out over the lower courses. At the point of worst bulge, the slip was about six inches. This situation is shown in the accompanying illustration of one of the observation holes, which shows clearly how the concrete facing was pushed away from the lower section of the wall by the outward movement of the upper section. Examination of the masonry joints at and about the plane of slippage showed that the mortar used originally had disintegrated badly, leaving substantially a dry masonry wall.




Plan Showing Relation of Tracks and Retaining Wall and Location of Dowels Provided in Wall.

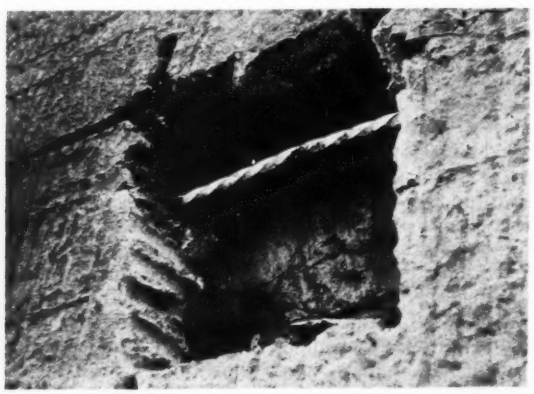
While the condition of the wall was recognized as undesirable, concern for its safety lessened as repeated

measurements over an extended period showed that a degree of stability had been reached, and that further movement was at a very slow rate, having amounted to only about 1½ in. at the worst place in the year following the initial slip.

### Doweling and Grouting Method Devised

To devise the most feasible and economical solution for the slipping wall presented quite a problem. To rebuild it, with the necessity of installing falsework under at least the two nearest tracks, was estimated to cost approximately $90,000. Filling in the alley to afford the wall an earth buttress would lead to property damages and, in any event, would not be permitted by the city because of sewers beneath the alley. Masonry buttressing would involve considerable expense and, possibly, foundation problems, and, at the same time, would at least partially block the alley, with accompanying expense, if permitted by the city.

A number of other possible solutions were given consideration, including the tying of the wall back to anchorages in the railroad embankment, but these were all discarded in favor of the relatively simple expedient of stopping the movement of the upper section of masonry by placing pipe dowels vertically down through the wall, and then internally rebonding the masonry blocks together with cement grout forced through openings in the pipes. At the section of greater distortion, 11 dowels spaced 8 ft. center to center, were

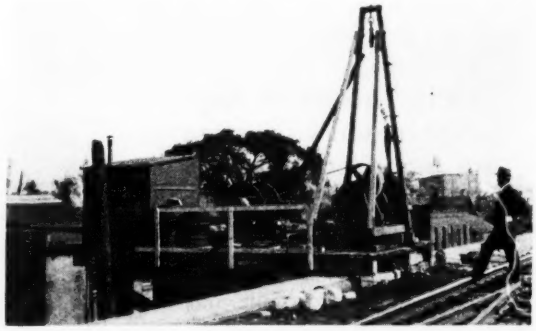


A Close View of Observation Hole No. 8, In the Section of Greater Bulge, Showing How the Concrete Facing Had Been Pushed Away From the Stone Masonry

deemed necessary, while at the point of less distortion, 5 dowels, on the same centers, were considered adequate.

Only the work at the point of larger bulge has been completed at present, the work at the point of smaller distortion having been deferred temporarily. Where completed, eight-inch steel and wrought iron pipe dowels were used, and were placed in 10-in. core drill holes driven vertically down through the wall to its base, along approximately its longitudinal center-line. Upon the completion of the drilling of each hole, a length of the dowel pipe, with staggered openings, about 2 in. by 4 in., cut in it, was inserted in the hole and then filled with grout of 1-2 mix. Under its own head and the force of a wooden rammer operated by hand power, the grout flowed out through the pipe perforations into the voids in the old mortar joints. In each case, the grouting was continued until settlement below the top of the hole ceased.

That there was general diffusion of the grout throughout the joints in the wall was evident from the fact that the grout appeared in the face of the masonry, and by the further fact that, whereas the volume measurement of the holes themselves was only about 11 cu. ft., all of the holes took grout far in excess of this volume; some as much as 34 cu. ft. At the outset of the work, consideration was given to reinforcing the grout cores with sections of worn steel rails, but this



The Working Platform at the Track Level Before Being Enclosed, Showing the 10-in. Core Drill Over the Wall Coping

plan was abandoned and dependence against further slip of the wall was placed entirely in the shearing strength of the grout-filled pipe and in the bonding strength of the regrouted joints.

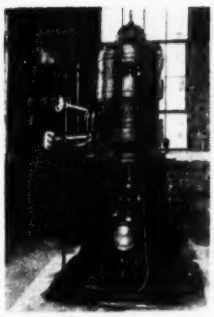
### Simple Equipment Used

All of the work of drilling the grout holes, placing the pipes and mixing and placing the grout was done from the platform of a movable frame tower, erected in the alley and moved along the face of the wall as desired. This structure, which was mounted on flanged wheels supported on runways of old 105-lb. rails, spanned the alley and provided vertical clearance of 10½ ft. beneath its lowest cross members for the free movement of such traffic as used the alley.

The working platform, with an area of 22 ft. by 16 ft., was cantilevered over the top of the wall so that the core drill could be mounted in working position without throwing any of its weight on the wall. This setting of the drill was sufficiently distant from the nearest track to preclude interference with train movements on it. The gas engine driving unit of the drill was mounted toward the rear of the platform, where it tended to counterbalance the cantilevered weight of the drill. Shortly after the work was started, the drill platform was housed over completely to protect the equipment and workmen in inclement weather, and also to eliminate the necessity for employing a watchman at night. Mixing of the grout was done by hand in a low mortar box laid on the track shoulder, close to the wall.

The work of strengthening the point of worst bulge in the wall, which was started early last fall, was discontinued during the winter because of the danger of the grout becoming frozen, but has since been completed. Measurements made indicate that further slip in the wall at the point repaired has completely stopped, and that the repairs made will be permanent.

The work was carried out by a small force, including a driller and two helpers, and a mason and a mason helper, acting under the general direction of A. W. Carpenter, engineer of bridges, and P. H. Winchester, division engineer, and under the immediate supervision of E. L. Jenkins, supervisor of bridges and buildings, and W. E. Malott, general foreman of drillers.



# What Kind of a Deep-Well Pump?

## A. R. E. A. committee reviews some recent developments in equipment designed for this type of service

A SUMMARY of the most recent improvements in equipment for deep-well pumping, together with a review of the practical considerations that enter into the selection of the equipment for such use, was featured in a progress report presented before the last Convention of the American Railway Engineering Association by its Committee on Water Service and Sanitation. This report, which was prepared by a subcommittee of which J. P. Hanley, water service inspector on the Illinois Central at Chicago was chairman, is presented below.

The steam head deep-well pump of the single plunger type was the pioneer of its class and was developed between 1870 and 1875. Prior to its introduction, reciprocating surface pumps were used to pump water from open wells and were usually installed on a platform near the bottom of the wells. With these pumps, the yield of open wells was limited, and when the drilled well was introduced as a better method of tapping deeper or more productive water formations the steam head pump became a necessary part of its equipment. This type of deep-well pump was favored by railways between 1880 and 1900, and many are still used at stations having a limited water demand. While this pump has a low efficiency its maintenance cost is low and it is reliable in operation. This type of pump has been improved and adapted to belt and gear drives and for oil-engine and other present-day forms of power.

When the water demands of the railroads began to exceed the capacity of the single-acting pump, the double-acting cylinder pump was developed. This pump has a capacity approximately 50 per cent greater than a single acting pump of the same plunger diameter and speed and is operated by a single line of pump rods. It has been improved and adapted to present-day forms of drive and power.

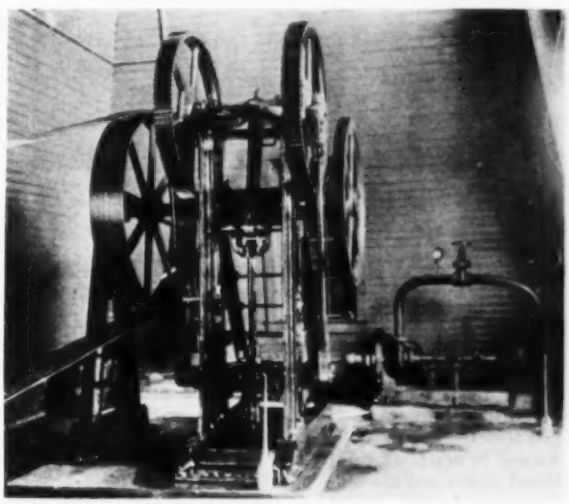
### Two-Plunger Pumps

The two-plunger pump was developed to increase the pumpage of water from a well without increasing the diameter of the pump plungers, which is limited by the inside diameter of the well casing. It has greater pumping capacity under similar conditions of speed and plunger diameter than either the single-plunger pump or the double-acting cylinder. It has, however, the disadvantage of having two sets of pump rods, with their additional weight and higher maintenance costs.

This type of pump has been improved in recent years by an arrangement of cams or pinions which start one plunger on the pumping cycle of its stroke just before the companion plunger has finished this part of its cycle and is ready to start the descending or idling stroke. This arrangement serves to keep the water in constant flow and avoids starting strains. Another recent improvement in this and other forms of deep-well plunger pumps is a patented spacing ring for the plunger leathers, whereby the angle of bending or cupping of the leather is reduced from 90 deg. to approximately 70 deg. This change greatly prolongs the serviceable life of the cup leathers, with resulting lower maintenance costs and more satisfactory operation of the pump. The two-plunger pump has also been improved in recent years by better oiling arrangements, better balance of moving parts and greater compactness. It has been adapted to gear, chain and belt drives and for motor and other forms of power.

### Deep-Well Turbine Pumps

About 1910 the deep-well turbine pump began to attract attention for irrigation projects and as its development progressed, it secured favorable consideration from municipalities, railways and other users, and is now the outstanding development in the deep-well pump industry. The turbine is adaptable for pumpages of from 50 gal. to



A Deep-Well Double Action Pump Operated by an Oil Engine

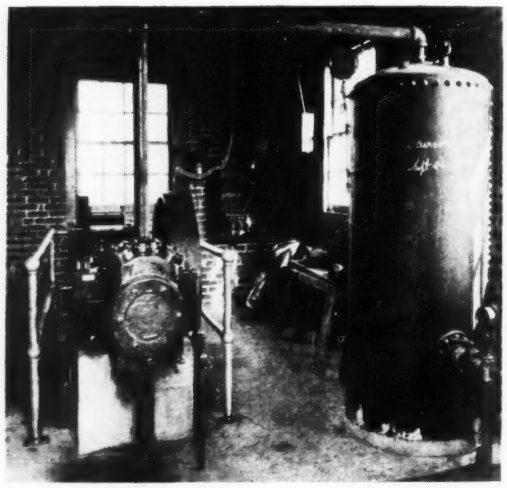
6,000 gal. per min. and for very deep installations. One pump manufacturer is now experimenting with a deep-well turbine pump in which the motor is submerged below the pump in a water-tight casing, submarine cables being used to convey current to the motor. If this unit is developed successfully, it will mark an epoch in deep-well pumping, by eliminating pump rods and considerable pump housing, and by permitting the pump to be set an unlimited depth in the well.

At Etiwanda, Cal., there is a deep-well turbine installation which pumps 1,800 g. p. m. against a total head of 640 ft., of which 450 ft. is in the well and 190 ft. above the surface. This pump operates at a speed of

960 r. p. m. and is driven by a 350-hp. vertical motor. Among other deep well installations that may be mentioned are one in a Colorado mine, which delivers water from a depth of 750 ft.; another in Mexico, with 860 ft. of pump setting in a shaft; and a third at Monona, Iowa, which delivers 318 g. p. m. against a total head of 638 ft. The first three installations mentioned are of tandem design, one group of impellers and bowls being located at the bottom of the pump rods and another group near the surface of the ground. This type of turbine pump uses rubber bearings of fluted design, lubricated with water. The last mentioned installation has metallic, oil-lubricated bearings and 19 enclosed impeller stages at the lower end of the drop pipe at a depth of 500 ft. from the base plate of the pump to the first stage.

### Air Lifts

While installations of the air lift are not as numerous as those other forms of deep-well pumps, this method has a certain well-defined field in which it is superior



**A Single-Stage Belt-Driven Air Compressor for an Air Lift of Moderate Capacity**

to other forms. This is illustrated by the success which the Atchison, Topeka & Santa Fe has had with air-lift pumping in Arizona. The following abstract of a paper presented before the Arizona Public Health Association in 1929 by G. L. Davenport, Jr., assistant engineer on the Santa Fe, is given here to illustrate an unusual air-lift installation.

Water from deep wells in the western part of Arizona is pumped in nearly all cases by air lifts. The combination of the Diesel engine and the air compressor has solved the problem of deep well supplies. Contrary to popular opinion, shared by many engineers, the air lift is superior to the reciprocating pump in overall efficiency for lifts of 400 to 800 ft. A concrete example of this is presented at Pica, Ariz., where a lift of 900 ft. is made from three wells varying in depth from 1,546 to 1,788 ft. In 1917, with two 40-hp. Diesel engines driving reciprocating pumps in the two wells then drilled, 10,000,000 gal. of water was produced at a certain cost. In 1927, with 430-hp. Diesel engines driving air compressors, 60,000,000 gal. of water were produced at the same total cost as in 1917. The reason for this great decrease in the cost per thousand gallons is the almost complete absence of maintenance work on the underground facilities of the air lift, whereas frequent renewals of the pumps and pump rods of the displacement pumps were required. In shallower wells, turbine pumps operated by smaller semi-Diesel engines have been found more suitable.

A summary of the information received from members of the Committee on Water Service and Sanitation, in reply to a questionnaire asking for information on wells and deep-well pumps on their respective railways is given below:

| | |
|---|---|
| Number of railways reporting | 14 |
| Number of wells in use for large water supplies | 623 |
| Diameter of well—greatest | 72 in. |
| Diameter of well—least | 2 in. |
| Depth of well—greatest | 2,750 ft. |
| Depth of well—least | 20 ft. |
| Formation, rock | 153 |
| Formation, unconsolidated | 470 |
| Gravel-walled wells | 94 |
| Deep-well pumping installations | 463 |
| Air lifts | 40 |
| Single-plunger pumps | 195 |
| Two-plunger pumps | 81 |
| Turbine pumps | 118 |
| Miscellaneous types | 29 |

Type of pump preferred for average conditions—turbine

### Conclusions

1. The types of deep-well pumps now generally used are the single or double-plunger displacement pump, the turbine pump, and the air lift.

2. Displacement pumps may be considered for pumpages of 50 to 300 g. p. m. and for various depths of pump setting, which usually should not be greater than 300 ft. The pump speed should not exceed 25 r. p. m. The overall efficiencies of this type of pump will vary from 40 to 60 per cent.

3. The turbine pump may be considered for pumpages of 50 to 6,000 g. p. m. and for depths ranging from shallow settings to settings of 500 ft. or more. This pump is undergoing rapid changes in design, size and capacity and its ultimate possibilities cannot be definitely stated at this time. Overall efficiencies of 60 per cent are obtained.

4. The air lift may be considered for a wide range of pumpages and for settings of greater depth than might be suitable for other pumps. It is more suitable than other pumps for installation in crooked wells or in wells which produce considerable quantities of sediment. Overall efficiencies vary from 25 to 40 per cents.

5. The type of installation can best be determined by a careful study of all local conditions, including the probable operation and maintenance charges and the interest and depreciation on the investment.

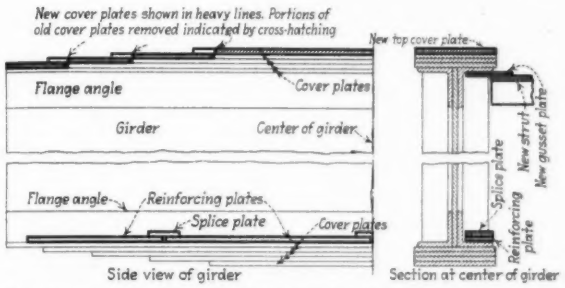
# Corroded Cover Plates on Deck Girders Replaced

THE corrosion of the top flanges of the girders of five 84-ft. 6-in. deck spans of the Missouri-Kansas-Texas bridge over the Arkansas river at Osage, Okla., gave rise to a repair job that was completed without the use of falsework, although it involved the renewal of all parts of the cover plates in the top flanges that had exposed surfaces. No repair work had previously been done on the superstructure of this bridge since its erection in 1903.

As built, the top flanges of these girders had four cover plates 14 in. wide by 9/16 in. thick and 84 ft. 6 in., 61 ft. 5 in., 52 ft. 2½ in., and 36 ft. long, respectively, and the exposed tops of these cover plates were so badly corroded as to result in an appreciable loss of section. Moreover, the placing of new plates over the old ones would have given an unsatisfactory job. Accordingly, it was decided to replace the top plate completely and also those portions of the other plates that had exposed top surfaces. This, of course, intro-

duced joints in the three lower plates at the ends of the plates next above, so the new plates except the ones for the bottom tier were ordered long enough to lap over the joint in the next plate below and thus serve as a splice. The plates were delivered to the bridge cut to length and punched to match the rivet holes.

The work of renewal was started at one end of a girder, burning off the rivet heads and cutting through the plate at the end of the cover plate next above. Following this, the new plate was riveted in place and the process repeated on the next two cover plates. After the same operation at the other end of the girder, the top cover plate was replaced. By proceeding in this way, only a part of one flange was crippled at a time and the girder was not weakened enough to require falsework.




**Side View and Section of a Girder Showing New Material by Heavy Lines. Cross Hatching of Cover Plates Indicates Portions of Old Plates that were Removed**

In the case of the bottom flange the corrosion was confined primarily to the top of the inside flange angle and the loss of section was corrected by adding a plate ½ in. by 5 in. on top of the inside angle for the entire length. To avoid crippling the entire flange at one time, this plate was applied in four lengths of about 20 ft. each, with splice plates over the joints. In addition to the repairs to the girder flanges, all of the top lateral gusset plates and the top struts of the cross frames were replaced.

We are indebted for the above information to G. L. Staley, acting bridge engineer, under whose supervision the work was done.

# Ann Arbor Devises New Type of Safety Contest

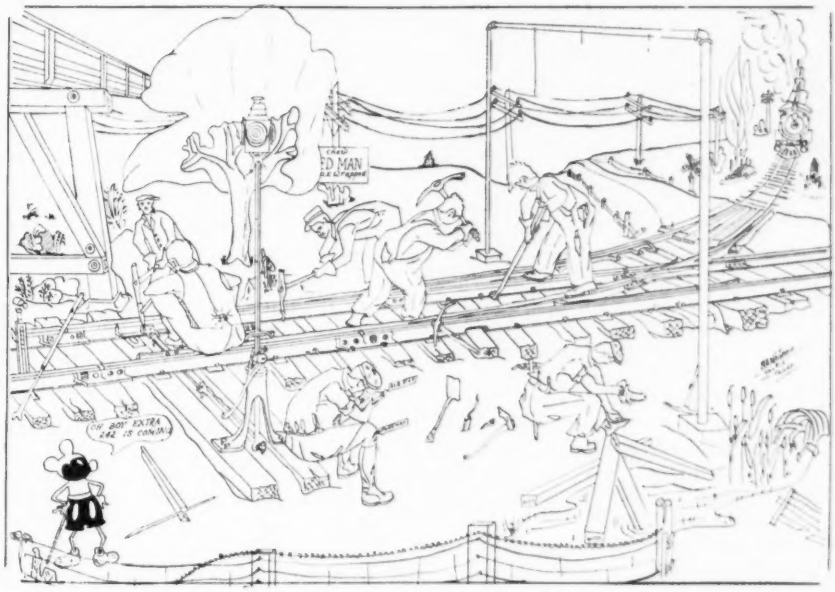
HOW many rules of safety and maintenance of way practice are being violated in the accompanying drawing depicting a track gang at work? This question was asked the track foremen and some of the trackmen on the Ann Arbor in a recent drive to reduce accidents among maintenance of way employees, and establish a new safety record for that road.

A tabulation was made of all infractions of safety and other maintenance of way rules of this company that are depicted on the drawing and then a copy of the drawing was submitted to each track foreman on the Southern division of the railroad with instructions to list as many violations of the rules as he could find. The list prepared by each foreman was then checked against the master list of violations and the results compared.

The safety and maintenance of way rules of the Ann Arbor are being violated in 71 different ways in the drawing, either by the action of the men themselves, or by the condition or position of the various objects. The highest number of infractions of the rules found by any one foreman was 62 and the smallest number was 11.

If you desire to test your own knowledge of safe practices, study the drawing carefully, make a list of all the rules that are being violated and then compare your list with that compiled by the railroad and presented on page 549 of this issue. It will be noted that this list contains but 33 items, the reason being that a considerable number of the faulty practices in the picture are covered by more than one rule on the Ann Arbor, so that in the company's compilation of infractions single faulty practices were sometimes listed more than once. Moreover, it was thought that some of the items listed by the railroad might not be covered by rules on all railroads and these, too, were omitted

We are indebted for the information given in this article and also the drawing to W. R. Bennett, division engineer of the Ann Arbor. The drawing was made by M. A. Whitmore, a trackman on this road.



**What Is Wrong With This Picture? How Many Violations of Maintenance of Way Safety Rules and Practices Can you Detect?**

Driving in of the Bars is an Important Part in the Proper Application of Rail Joints

# Rail Joints and Their Maintenance*

## Discusses various practices and stresses importance of proper application and upkeep

By WILLIAM E. GADD
Rail Joint Company, New York

WHEN discussing rail joints, there are many angles of the subject which invariably arise and which cannot be overlooked. Certain of the more important of these include the subject of tie spacing, the question as to the proper method of applying joint bars, and the importance of keeping joints tight. The question of joint-tie spacing is apparently as far from being settled today as it ever was. Practices still vary on the different roads, and the results secured from the different practices vary considerably.

### Summary of Joint Practices

Most of the roads that use 38-in. or 39-in. joints of the angle-bar type place three ties under the joint, one at the center and one at each end. It is the intention, we believe of these roads that do not now use three ties to do so eventually as the rail is worked over. To our knowledge, there is only one road which has taken the stand that two ties under long joints are sufficient. This road uses a 30-in. base plate with edges bulldozed upwards for reinforcing. At the time that rail is renewed, this plate is placed on two ties, temporarily, whenever the rail ends come over the edge of a tie, or between two ties, while if the ends come approximately over the center of a tie, the regular tie plates are used. Eighty to ninety of these long plates are usually required per mile of track, and they are released for further use after the track is worked over and the ties respaced.

Roads using angle bars 24 in. to 28 in. in length are apparently divided on the question of joint support, some using two ties, thereby suspending the joints, and others laying their joints "hit or miss." Some roads use the base-supported type of joint which suspends the joints over two ties, while others contend that this practice is not necessary and let their joints come where they may.

In spite of this difference in practice, there seems to be one definite idea in the minds of all and that is to provide the best possible support for the immediate ends of the rails. Many roads claim that this is accomplished by the use of the 38 or 39 in. angle bar, while others are equally strong in their contention that the shorter base-supported 24 to 28 in. joint accomplishes the desired result. In all probability both are correct. It is interesting to note that for a number of years base-supported joints have not been furnished in lengths in excess of 28 in. Of equal interest is the fact that recently many roads that formerly used 24-in. or 28-in. joints of the angle-bar type, have changed to 38-in. or 39-in., and, in one instance, to a 44-in. joint, particularly for 110-lb. sections of rail and heavier.

I call your attention to a few details which may appear to be of minor consequence, but which, in reality, are of utmost importance in enabling you to secure the best results from the joints you use, regardless of their length or type. One of these details has to do with the proper application of the joint bars to the rail.

When applying joint bars in rail-laying operations, one of the first operations should be the thorough cleaning and oiling of the fishing surface of the rail ends and joint bars. To secure the best possible alinement of rail ends and joint-bar fit, the proper tightening of bolts should be given careful attention. From past experience we have found that the following procedure works out excellently.

First, alternately tighten the two center bolts, regardless of whether a four or six-bolt joint is used; next, drive the gage bar inward on the base, or toe; then tighten the next two bolts. Following this, drive the outside bar inward and complete the tightening. This procedure prevents one end of the joint from being pulled in too far, resulting in the other end being flared outward. Then, too, it aids in seating both bars more uniformly. It is important to emphasize that this same procedure should be followed when power tighteners are used. Too often all of the bolts are tightened and the driving of the joint bars is neglected.

It is particularly important that the bars are seated squarely when applying insulated joints. Failure to drive the bars on the base invariably results in their being "cocked" inward at the top, making a very poor fit. In the case of an insulated joint, this means short life for the fibre parts. The second tightening of bolts should follow the rail laying within four or five days, and the third or final driving and tightening should be given the joints in from three to four weeks.

The foregoing is of the utmost importance when applying insulated joints. Too careful attention cannot be given the proper insertion of the insulation; that is, the fibre base and head pieces. First, though, the rail ends must be free of all rough edges and foreign particles. If cut rails are used, they should be "passed" to remove the cut ends from the insulated joints. Above all else, do not attempt to force the bolts through the bushings. If the rails are just tight against the end post, no trouble should be experienced in assembling the joint. We have seen instances where the bushings have been omitted merely because the joint was difficult to apply owing to the

*This is part of a paper presented before the Metropolitan Track Supervisors' Club, New York. The first part of the paper was a veritable encyclopedia of facts with regard to the different types of rail joints in use on the railways of the United States and Canada, while the latter part, which is presented here, deals more specifically with field practices and joint maintenance problems.

gap at the rail ends being a trifle wide, and, apparently, it was too much trouble to drive them together.

The beveling of rail ends at ordinary track joints is now common practice on many roads. However, the rail ends within insulated joints are seldom, if ever, beveled. In our opinion this is not as it should be. If the rail ends in the ordinary joints are beveled to retard the flow of metal, why not apply the same practice to insulated joints, where extra precautions are necessary to preserve the end posts and to prevent contact between the rail ends? The so-called undercut end post is widely used today, and we can see no reason why the rail ends at joints using this type of post should not be beveled, providing the depth of the bevel does not go deeper than the top of the end post. The best tool for doing this

Tightening The Two Center Bolts First Is An Essential of Proper Joint Bar Application

beveling at insulated joints is a large coarse file, and the beveling should be done before the rails are laid in place. Beveling of the rail ends by machine, after installation, is likely to damage the end post and may permit particles of metal to fall into the opening between the rails.

The use of abrasion plates under insulated joints, particularly where the rail is canted, is a great aid in maintaining surface and alinement, and in reducing wear of ties, as well as in prolonging the life of the insulation. This is because the abrasion plates overcome, largely, or entirely, the twisting action through the joint occasioned by the unsupported outside bar.

### How Tight Should Bolts Be?

The question of the extent to which bolts should be tightened gives rise to much discussion and reveals diversity of opinion. Whether you do or do not use spring washers, the tension in the bolt should be only sufficient to hold the joint bars into their proper bearing surfaces on the rail, without lateral movement under impact. To bring this about is quite a large order, but remember—you must give the bolts a "break." In other words, do not try to make the bolts do the work of the joint ties. If the bolts are to function in a proper manner, the ties must give the joint structure support.

Now arises the question, what bolt tension should you have and how can you regulate it efficiently and accurately? Briefly, we may state that various roads have found that a maximum of 20,000 lb. per sq. in. is ample. There are certain power machines used for bolt tightening, which produce the desired tension by means of a release, with a reasonable degree of accuracy. Then, too, certain types of spring washers, when compressed to the limits specified by the manufacturer, will give the approximate tension desired.

To secure the best results from your joints, the bolt tension must be correct and uniform. Bolts that are too tight may be just as detrimental to a joint as bolts that are too loose, for they may interfere with the normal expansion and contraction of the rail, and thereby cause rail creepage and damage to the fibre in insulated joints. When the regular joints "freeze," expansion and contraction become excessive in the insulated joints, since the frictional resistance to longitudinal motion between the fibre insulation and the metal of the rail is not as great as between the metal of the rail and the bare metal of the bar. Overstressing of the bolts damages the spring washers and causes the bolts themselves to be elongated, often to the point of breakage. When bolt breakage occurs, the stresses in the joint are unequally distributed. This, in turn, is reflected invariably in the condition of the rail ends, since it causes flow of metal, batter and even fractures.

Remember that in the maintenance of joints one is not dealing with a machined fit, but rather with rolled sections having permissable variation, and, that if you give the joints an even chance, your efforts will be more than repaid. Keep them tamped, oiled and properly tightened. The manufacturer has done his best in making the joints—beyond that, it is up to you to get the most out of them.

## Infractions of Rules Shown on Ann Arbor Picture

THE following is a list of the things that are wrong with the picture shown on page 547 from the standpoint of safety and sound maintenance of way practice. The asterisks indicate items that pertain to safety.

*1 No white flags on extra
*2 No flag protection (Overhauling switch)
*3 Switch unlocked and men around switchstand when train is approaching
*4 Switch rod bolts and connecting rod bolts not turned upward and fitted with cotter keys
*5 No target on switchstand
*6 Switch lock not fastened to stand
*7 No switch braces
*8 Switch lamp lined incorrectly
*9 Switchstand not spiked in proper position
*10 Step on switchstand upside down
*11 Improper care and use of tools
*12 Improper supervision of men by foreman
*13 No goggles worn by men cutting metal
*14 Using spike maul instead of sledge on cutting tool
*15 Personal injury not attended to by foreman
*16 Workmen standing within range of tools of others
17 Growth of vegetation under bridge and around poles
*18 Road crossing in need of repair
19 Fences in need of repairs
*20 Ties piled improperly
21 Ties piled in place subject to overflow
*22 Pick stuck into tie
23 Piling and burning ties under telegraph wires
*24 Rail left near switch stand
*25 Half-moon break in base of rail
*26 Broken angle bars
*27 Joint bars not fully bolted
28 Spikes driven improperly
29 Tie plates used in place of switch plates
*30 Tie plates not properly placed
31 Unequal distribution of expansion at rail ends
*32 Tell tales in unserviceable condition
33 Whistling post on wrong side of track

# Raise Freight House Roof With Track Jacks

## Gulf, Mobile & Northern employs interesting method in adding second story to brick and concrete structure at Jackson, Miss.

USING ordinary track jacks as the lifting medium, the roof of a one story brick freight house, 40 ft. by 300 ft., on the Gulf, Mobile & Northern at Jackson, Miss., was recently raised sufficiently to provide space for a second floor. While the time available for completing the work was short, during all of which period the freight house remained in operation, the project was carried to completion in an economical manner.

The original structure was a one-story building of brick construction with a concrete floor and foundation and with the roof covered with asphalt shingles, laid four inches to the weather. The roof was supported by 26 framed wooden trusses, spaced 12 ft. center to center, which were supported directly on the side walls. It was proposed to add a second story, which would require the raising of the roof a total distance of 13½ ft. A 20-ft. one-story addition was also constructed at one end.

### Make Two Lifts

The plan that was followed for raising the roof was to make two lifts, the first one with the jacks located at the floor level and the second one with the jacks located on the second floor joists, the jacks being moved after the roof had been raised sufficiently to allow the necessary headroom for workmen above the joists.

In the first operation, a jack was located on the floor at the wall under each end of every roof truss, the lifting force being transmitted to the roof by means of posts consisting of two 3-in. by 8-in. rough planks, one nailed to each side of the bottom chord with 60d nails and the space between the planks up to the bottom of the lower

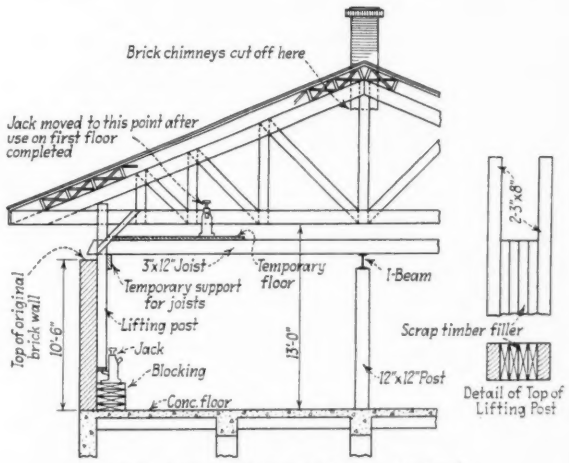
View of the Original Freight House

chord being filled with scrap timber of various sizes and nailed. These posts, which reached to within a few inches of the concrete floor, were knee-braced to the trusses with scrap timbers.

With the jacks and posts in the positions outlined above, the roof was jacked up 30 in., which was sufficient to permit the insertion of permanent center posts, longitudinal I-beams between the center posts and transverse second-floor joists. In jacking the roof up the first 30 in., the jacks were first placed directly on the concrete floor, using a tie plate to seat the bottom of the post on the foot of the jack. Blocking of scrap timber was then placed under the jacks as the jacking progressed. All jacking was done with the foot of the jack.

The joists consisted of 3-in. by 12-in. timbers and were spaced 12 in. apart except that a joist was placed on each side of each lifting post. Because of the fact that the bottoms of the joists were to be six inches higher than the top of the original side walls, the joists were temporarily supported on longitudinal timbers nailed to the lifting posts while the walls were built up to them.

At this stage of the project, a rough floor 10 ft. wide was laid on the joists around the building at the walls




Sketch Showing Method of Raising the Roof

in order to provide working space for the brick layers. Brick and mortar were hoisted to the second floor on a temporary elevator operated by a tractor, an opening being left between the joists for this purpose.

### Jacks Transferred to Second Floor

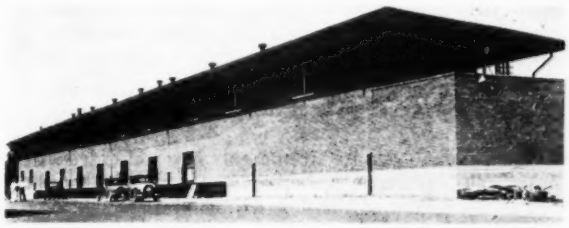
After the 30-in. rise, the jacks were transferred to the second floor, each being set on two 3-in. by 8-in. by 16 ft. timbers, in order to secure a uniform distribution of the load over the joists. From this point struts were used to raise the roof, the necessity for increasing the length of the struts as the roof was raised being reduced to a minimum by using the same blocking under the jacks that was used in the first lift.

The original lifting posts were allowed to remain in position throughout the procedure of raising the roof and were used to good advantage by nailing cleats of scrap material to them just above the joists about every two feet as the lifting proceeded, thus preventing the roof from falling in the event of a jack failure.

Following the transfer of the jacks to the second floor, the roof was raised several feet further and the brick laying was commenced even though at the beginning it was necessary for the workmen to stoop over because

of the lack of vertical space.

In raising the roof, it would obviously have been uneconomical to operate all the jacks simultaneously because of the large number of men required. Exclusive of this consideration, it was felt, moreover, that it would have been impossible to operate all the jacks at the same instant and that failure to do this would have the same effect as operating the jacks successively a notch at a time. For these reasons, the jacks were operated by beginning at one end of the building and raising the jack at each end of the end truss one notch and then proceeding from truss to truss down the length of the structure. At the opposite end of the building the jacks under the end truss were raised two notches and the process was repeated in the opposite direction. Because of the 12-ft. spacing of the trusses, it was found that there was practically no distortion of the roof due to the manner of operating the jacks and that the asphalt shingles were not damaged.



In This View the Roof Is in the Final Position, With the Walls Unfinished

Because of the lack of headroom, the laying of the upper courses of brick became extremely difficult and for this reason it was necessary to raise the roof about two inches higher than its final position to permit the top bricks to be layed. Even with this additional working space, the difficulty was not entirely overcome.

In making preparations for raising the roof, the ornamental wood brackets that were located at intervals under the eaves entirely around the building were taken down and scrapped. The down spouts extending from the roof were severed and additional lengths inserted after the roof had been raised to its final elevation. Because of the installation of gas heat in the enlarged structure, the two brick chimneys were severed at a point near the roof, the upper portion being fastened to the rafters and allowed to remain in position.

View of the Completed Structure

We are indebted for the information contained in this article and for the illustrations to L. P. O. Exley, chief engineer of the Gulf, Mobile & Northern, who exercised direct supervision over the planning and execution of the work.

# Fairmont Ballast Cleaner Used on Pennsylvania

THE cleaning of five miles of single track in one working day is the performance secured by the Pennsylvania with the Fairmont ballast cleaner, according to a statement issued by G. E. Payne, regional publicity agent of the Central region, of this road on which this machine has been employed during the past summer, in connection with the season's program of ballast cleaning. This Fairmont machine, together with other smaller types of equipment, cleaned over 500 miles of track in this territory during the summer and it is expected that nearly 100 miles more will be covered before heavy frost prevents the operation of machines.

The large machine, which was developed by Fairmont Railway Motors, Inc., Fairmont, Minn., was described in *Railway Engineering and Maintenance* for March, 1932, page 204, following its initial experimental use.

The Fairmont Ballast Cleaner in Operation

The plant, which is mounted on a flat car 65 ft. long and weighs 105 tons, is designed to plow up the ballast along each side of the track, screen it, return the ballast to the roadbed and dispose of the dirt either in dump cars hauled behind the cleaner or on the roadbed shoulder. The following information concerning the construction and operation of the machine is taken from the statement issued by the Pennsylvania.

The unique feature of the design is that all the equipment for picking up the ballast and cleaning it is housed in two steel boxes weighing 16 tons each that are mounted on either side of the car in such manner that they can be swung out and lowered into position for operation or drawn in flush with the sides of the car to clear trains on adjacent tracks in a minute's time, so that the operation of the ballast cleaner involves a minimum of interference with traffic on adjacent tracks.

## Method of Operation

The cleaning boxes are equipped at the front with two heavily reinforced wings 30 in. high that are spread or contracted by means of hydraulic cylinders. When the boxes are let down into the ballast, the wings dig into the stone and dirt to a maximum depth of 10 in. below the bottom of the ties. The forward motion of the car plows the ballast into the boxes where chain conveyors carry the material up over a series of steel screens to the cleaning apparatus.

Here it is agitated and thrown about, the dirt dropping down to be caught by another conveyor, while the cleaned ballast is carried back to the rear of the box where it is distributed again to the track. The dirt is either stored in a dump-car unit coupled behind the cleaner or deposited over the roadbed shoulder. As operated on the

Pennsylvania, this machine is equipped with a belt conveyor 22 ft. long that can be swung out from the side of the car so that the dirt may be conveyed to the shoulder across an adjoining track. This is done, of course, only in locations where the disposal of the dirt in this way would not be objectionable.

There is a steel cab on the forward end of the car from which the operations are controlled and that serves also to house a 175-hp. gasoline engine direct—connected to a 100-kw. electric generator that supplies current for the operation of various functions of the plant. Eleven electric motors are required for these various operations. Another gasoline engine mounted at the rear of the machine provides power for the dirt dumping apparatus.

Two gas-electric locomotives, providing a total of 535 hp. are used in propelling the cleaning machine. They move ahead of the cleaner on the track, set their brakes, and the cleaner pulls itself up to them on a steel cable at a speed of approximately one-half mile an hour. The cable is wound on a drum in the cab of the cleaner, driven by a 125-hp. gasoline engine.

Among advantages of the equipment cited in the statement are that it is equally efficient in work on the ballast shoulder and the inter-track space, that it cleans ballast on both sides of the track at once, that it cleans the ballast to a uniform subgrade depth and that the return of the clean ballast is attended by the use of a ballast shaper that restores the ballast and roadbed contour. The statement concludes with the following: "Results of practical operation this season indicate, according to railroad officers, that the new apparatus marks a distinct advance in the efficient and economical cleaning of ballast, and in the more thorough and complete renovation of the roadbed."

# Why Do Bolts Get Loose?*

BY C. H. R. HOWE

Cost Engineer, Chesapeake & Ohio, Richmond, Va.

LOOSE track bolts result from a combination of mechanical actions that may be classed roughly as (1) the wear produced by the friction between the assembled parts of the joint when in motion under load; (2) the effect produced by the movement of the rail during changes of temperature; and (3) premature fatigue of bolts as a result of overstressing.

Since the first of these causes is by far the most important, the affecting factors become of vital interest in making a study of the subject. There are two distinct mechanical actions that occur at a joint under moving loads. The first is the normal deflection of the rails and joint bars under load, but since there is ordinarily considerable discrepancy between the girder strengths of the rail and bars, their deflections differ, causing friction of varying magnitude along lines of contact. This results in irregular wear. The problem of rail-section and joint-bar design is one for the engineer and not for the trackman, who must take materials as they come to him.

Common sense, as well as even an elementary knowledge of physics, indicate that the reaction of tie, ballast and roadbed must counteract the bending moment in the rail itself. Trackmen can and do provide for this by keeping the timber sound and well tamped. Furthermore, a good trackman keeps the ballast at the joints clean and well drained.

The second action at the joint when under load, which results from the impact of the wheels passing from rail to rail, is not only extremely damaging to the rail itself, but also affects the life of the ties and the ballast. Further than this, it necessitates excessive tamping of the ties at these points. Present methods of rail application require that an allowance for expansion be provided between the rail ends at joints. To minimize the unfortunate results of this necessity, the expansion gaps should be maintained to a uniform width. To a large extent this can be done by providing sufficient rail anchors to insure that the movement in expansion of each rail will be confined to that rail, thus avoiding the creeping which otherwise closes some gaps and widens others.

### Width of Gap and Rate of Batter

Obviously, the width of the gap has a decided effect on the rate of batter on the end of the receiving rail, as well as the extent of the flow of metal at the end of the leaving rail. It is equally obvious that as the batter increases, the intensity of the impact increases, and that this in turn increases the vibration in the joint, thereby accelerating the loosening of the bolts. When the bolts become loose, bending moments cannot be bridged across the joint, so that the resulting concentration of pressure on the ballast results in a low spot and possibly a bent rail. To retard the rate of batter and the unpleasant consequences which ensue, the practice of heat treating and beveling rail ends has been found to be very effective. Recent experience has shown that the rate of batter can be reduced by such treatment to 25 per cent of the former rate. This increases the interval between weldings, lengthens the life of the rail and reduces spot surfacing costs.

Motion of the rail in expansion and contraction, the second mechanical action at the joint, produces frictional wear of the parts in contact, similar to the action under applied loads. In this case, however, the wear is more nearly uniform and can be controlled by proper maintenance. It is apparent that if the expansion of the individual rails is to be self-contained, provision must be made for movement of the rail ends between the angle bars. It is also further in evidence that if freedom of motion between the angle bars is to be maintained, care must be taken not to over-tighten the bolts, or in other words, not to "freeze" the joints. To obtain this freedom of movement between rail and bar, and at the same time maintain the rails securely in alinement, washers having considerable spring resistance are required on the bolts. These washers serve not only as a means of taking up the wear between parts and the loss due to back turning of the nuts, but they also provide the resiliency necessary to absorb the shock of impact from the rolling loads. It is the writer's opinion that too little stress has been placed on the effect that the spring washer has on the rate of flow, batter and chipping at rail ends, or in short, on the life of the rail. In a continuous test over a period of seven years, it has been developed definitely that the rate of damage to rail equipped with spring washers of proper material and design was only 50 per cent as great as on track with all joints "frozen." Obviously, the latter condition is abnormal, but it is pointed out to illustrate the fact that rail damage will result from overstressing bolts as well as from loose fastenings.

Finally, the third item, that of premature fatigue, is the result of overtightening and is under the direct control of those responsible for track maintenance. Not only is the primary damage due to the frozen joint present, but all of the ultimate damage which ensues from the weakened joint. The cure for this is proper instruction and supervision.

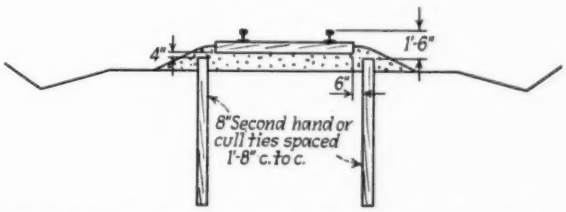
*This discussion was submitted for publication in What's the Answer department, but because of its scope it is presented here as an independent article. For further discussion on this subject see page 559.

# Use Caterpillar Tractor to Drive Ties in Soft Cuts

THE driving of a line of second-hand or cull ties into the roadbed on each side of the track in soft cuts has been adopted as an effective means of stabilizing these cuts on the Missouri Pacific lines following tests that were commenced about two years ago to determine the practicability of this method. In test cuts that were treated by this method, excessive settlement in the roadbed was eliminated and a normal track condition was obtained. While this means of treating soft cuts has been employed more or less extensively on other roads, the railroad unloads the ties through the cuts where they are to be driven and also furnishes such flagging protection as may be necessary.

An average of 20 to 25 ties per hour are driven, although the actual driving of each tie requires only from 10 to 20 hammer blows and the tie is driven in from 1 to 1½ minutes, including the time of moving the machine to the next position. The total cost of this work to the railroad averages from 45 to 50 cents per tie, or from 60 to 65 cents a track foot of track so treated.

Results obtained from this method are reported by the railroad to be excellent. In many cuts where it was formerly necessary to resurface the track once a week or even more often, this treatment has improved conditions to such an extent that surfacing is now required only once in six months or even less frequently. We are indebted for the information contained in this article to F. S. Schwinn, assistant chief engineer of the Missouri Pacific. The contractor on the work depicted in the illustrations was W. H. Nichols & Co., Inc., Dallas, Tex.




Typical Cross-Section of the Roadbed Showing Location of Ties

Missouri Pacific's method of driving the ties through the use of a Caterpillar tractor deserves comment as a means of speeding up the work and reducing the cost. Moreover, it adds another task to the list of maintenance jobs to which this type of equipment is readily adapted.

On the Missouri Pacific the ties are driven 18 in. center to center with the inner faces 6 in. from the ends of the track ties and the tops of the ties 4 in. below the bottom of the track ties. The equipment used in driving the ties consists of a Caterpillar tractor equipped with a full revolving crane having a 15-ft. boom, hammer leads and a 2,600-lb. drop hammer. Power for driving the piles is furnished by the tractor engine, the power take-off being at the rear of the tractor.

An Average of 20 to 25 Ties an Hour are Driven With This Equipment

The driving of the piles is done under contract, the contractor furnishing the equipment and the necessary crew for operating the driver and handling the ties, which consists of an operator and three laborers. The

Close-Up View of the Equipment Driving a Tie

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MOVEMENT OF CONSERVATION CORPS—The task of discharging men from the Civilian Conservation Corps as a part of the program for rebuilding the corps for the winter has been virtually completed, it was announced on October 21 at the office of Robert Fechner, director of emergency conservation work. Up to that date, according to reports received, a total of 123,346 men had been discharged or sent to their home states for discharge. A total of between 125,000 and 130,000 discharges was anticipated, and the work of enrolling new men in the various states to take the places left vacant by the discharge of men leaving was progressing.

Officers of the rail transportation section of the Quartermasters Corps of the War Department said that a total of 31,275 men have been moved from California and other western seaboard states to New York and other states in the east.

# What's the Answer?

**Have you a question you would like to have someone answer?**

**Can you answer any of the questions listed in the box?**

## Perforations Up or Down?

*When installing metal pipe for subsurface drainage, should the perforations be placed up or down? What are the advantages and disadvantages of each method*

?

### Prefers to Place Them Down

By G. J. BELL

District Engineer, Atchison, Topeka & Santa Fe, Topeka, Kan.

From our experience we prefer to place the perforations down, thus keeping the water table in the trench to a minimum elevation. Obviously, if they are up, the water must rise as high as the lower row of perforations before it can find an outlet. I am under the impression also that tests have shown sedimentation to be more rapid when the perforations are placed up. This seems reasonable, since water carrying sediment, if it flows through the permeable backfill over the pipes, is thus led directly to the holes, while if the water must settle to the bottom of the trench, it must also flow laterally to get into the pipe, and there would thus be less inflow of sediment. In placing this type of drain pipe, we lay it on three or four inches of crushed rock or similar material which is placed in the bottom of the trench.

### Says Down, But Notes Exception to Rule

By F. S. SCHWINN

Assistant Chief Engineer, Gulf Coast Lines, Houston, Tex.

In general, it is best to install metal pipe with the perforations down, but there are many exceptions to this rule. The governing factors are (1) the hydraulic efficiency of the drain; (2) the kind of drainage; (3) the nature of the soil; and (4) other local conditions. The hydraulic efficiency of any drain depends on the volume of water it collects from the soil and the amount of solids drawn into the line in a given time. The most efficient drain collects a maximum of water and a minimum of solids.

It is generally accepted that most of the water enters pipe laid with open joints at the bottom of the joint, and it is a common practice to cement the top half of such joints. Perforated pipe functions in the same manner with respect to collecting water. For this reason, the maximum efficiency of collection is attained when the perforations are placed down while the entrance of sediment is held to a minimum.

In determining whether bottom, side or top perforations should be used, the type of drainage desired is important. Obviously, the simple lowering of the water table is best accomplished with bottom perforations. This is also true in draining water pockets in embankments, provided the pipes have a free outlet. Perforated pipe for draining wet fills gives best results when laid in cross trenches on two or three inches of gravel and backfilled with gravel to the subgrade. Such installations are highly efficient in draining water pockets or preventing their formation, since they collect the water from each rain quickly and dispose of it. Any moisture remaining in the gravel below the pipe can trickle out without softening the roadbed. If no free outlet is provided, however, and the pipe leads to a manhole or junction box, provision must be made for disposing of this water. In this event, top or side perforations and no gravel in the bottom of the trench may be the best practice.

Drainage of yard tracks or track bays in terminals, where lines of pipe are laid between tracks without

### To Be Answered in January

*1. When laying rail on tangents, should the line or gage side be laid first? Why? Should the outer or inner rail be laid first on curves? Why?*

*2. Is manila or wire rope preferable as a hammer line for a drop pile hammer? Why? What are the proper sizes for each?*

*3. What are the indications of incorrect guardrail gage? Can these indications be caused by other track defects? If so, what?*

*4. What precautions should be observed to protect patrons and employees when painting the interior of stations and offices? How can interference with the use of these buildings be minimized?*

*5. In what way do treated ties fail? Untreated ties? What are the indications of decay and how do they differ?*

*6. What steps can be taken during the winter to anticipate emergency conditions in water supply, caused by thawing ice and spring floods?*

*7. When entering a cut in which there is a probability of stalling, to what extent should the flanger on a snow plow be raised and the wings pulled in? Why?*

*8. When repairing stone boxes, what methods can be used in replacing cap stones that have failed? Can the repairs be made with concrete? If so, how?*

laterals, may be accomplished by using bottom, side or top perforations, the choice being determined by considerations of cost, local conditions and the results desired. If the subgrade is of hard impervious material and the problem is merely to collect and remove rain water as it falls into the ballast, a good plan is to slope the subgrade on each side to the drain line, laying the pipe in the subgrade so as to leave the perforated top half projecting into the ballast. The loss of efficiency by placing the perforations up in this manner may be offset by the lower cost of installation and other advantages.

Subsurface drainage and the use of perforated pipe in the solution of problems presented, such as lowering water tables, intercepting surface or subsurface drainage or both, the drainage of water pockets, etc., constitute a broad specialty field which is difficult to discuss briefly. In this as in other engineering fields, the best results are obtained when a complete study is made of all of the factors entering into each problem and a decision based on the facts thus developed.

### Efficiency Less If Holes Are Up

By C. H. WOODRUFF
Draftsman, Engineering Advisory Committee, Van Sweringen Lines, Cleveland, Ohio

Perforated pipe serves the two-fold purpose of collector and conductor of subsurface water. If the perforations are up, the pipe has no collecting properties below the lower row of holes and the efficiency is lowered. There is also a loss of head which would otherwise act favorably to force the water into bottom perforations. When the perforations are down, gravity acts to keep sediment out unless it is washed into the pipe. Whereas when they are up, particles fall or are washed in more readily.

In cold climates, the ground around the top perforations may freeze, while the soil at the bottom of the pipe is unaffected. There is also a greater tendency for roots to enter top perforations than those that are placed down, especially of plants that penetrate the ground only a short distance.

If the perforations are down, water entrapped by silting or in sagged places during periods of restricted or no flow can leach back into the soil, while if they are up, the water can escape only through evaporation. Moisture affects the durability of the pipe, particularly if it is alternately wet and dry. Many ground waters dissolve corrosive substances, and as they filter into the top openings, the drippings tend to follow the inside contour of the pipe, causing objectionable corrosive action.

### Inlets Kept Open When Perforations Are Down

By J. L. SOUTHARD
Assistant Cost Engineer, Chesapeake & Ohio, Columbus, Ohio

Both experience and exhaustive tests conducted by manufacturers have proved definitely that metal pipe for subsurface drainage should be installed with the perforations down. The hydrostatic pressure at the point of entrance is greater than when they are up, the run-off is thus more rapid and the soil around the pipe is prevented from becoming saturated. During the run-off, the continued flow of water into the pipe keeps the inlets open, since there is less shifting of the earth at the flow line.

If the perforations are up, drainage stops at the lower row of perforations, thus tending to create a pocket of water to the bottom of the trench, which saturates the surrounding soil and causes it to shift at the least pressure from above.

Careful preparation of the trenches is of fundamental importance. Consideration must be given to the character of the soil, the area to be drained and the depth necessary to accomplish the desired drainage. Drains can be placed deeper in loose soils than in impervious clays for the same degree of effectiveness. Whatever the soil, however, pervious material, such as crushed stone or coarse gravel, should be used to backfill to at least six inches above the top of the pipe. Regardless of its depth, the trench should be at least twice as wide as the diameter of the pipe to insure complete encasement of the pipe in the porous material.

▼ ▼ ▼

## Fighting Snow On The Line

*What precautions should be taken late in the fall in preparation for fighting snow out on the line* ?

### Includes Fences, Ditches, Weeds and Equipment

By BERNARD BLUM
Chief Engineer, Northern Pacific, St. Paul, Minn.

To be prepared to fight snow, it is important that water courses, including culverts under the track, be cleaned and that accumulations of brush or drift be burned or disposed of otherwise. Snow fences should be repaired, and where portable panels are employed, they should be set up and anchored adequately. Attention should be given to removing shoulder weeds that may be high enough to stop the snow, causing it to drift onto the track.

One of the most important precautions is that of clearing the cribs at switch points and frogs to afford adequate and quick drainage away from the track. Accumulations of cinders or other material between yard tracks, especially along switching leads, should be removed so that maximum space is provided for snow. The necessity for cleaning cut ditches is obvious, since this not only provides space for accumulating snow, but also serves to minimize the tendency of the track to heave, besides providing for proper drainage in the spring.

All snow-fighting equipment, such as snow shovels, brooms, plows, etc., should be attended to and care exercised to insure that an adequate supply is available, as well as that the standard equipment is in first-class order. Bull-dozers and spreaders, which are primarily ballasting and bank-widening equipment, should be repaired by the beginning of winter, as there is a large field for their use, especially in terminal yards.

### Preparation Covers Many Items

By H. R. CLARKE
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Chicago

The precautions in preparation for fighting snow out on the line depend largely on the climatic conditions of the particular territory and the snowfall to be expected. Where the snowfall is heavy and snow sheds are maintained, a careful inspection and the necessary repairs to the sheds constitute an important part of the preparation for the snow that may be expected. Snow sheds are not in general use, however, on the roads in the Central West, at least in the Mississippi and Missouri river valleys.

Considering only the territory served by the Burlington, the precautions that should be taken are somewhat as follows:

First: Repair all existing snow fences and build new fences where experience indicates they will be needed, including portable fences that are set up in the fall and dismantled in the spring. Particular attention should be given to strategic points, such as turntables or wyes at engine terminals and to the protection of leads in important yards, where this can be done by erecting snow fences.

Second: Snow-fighting equipment should be inspected and put in first-class condition. On most large roads in this territory this consists largely of wedge plows. The preparation of these consists of mounting them on suitable cars, seeing that the cars are in good condition, and locating them at the points selected as headquarters. If rotary plows are used, they should also be inspected, necessary repairs made and the equipment put in first-class condition in every way. The preparation of equipment also includes the mounting of snow flangers on locomotives and the addition or repair of steam pipes around yards where these devices are resorted to in handling snow.

Third: As late in the season as it is considered safe, ballast should be cleaned from around switches and spring frogs and drainage around all switches should be put in the best possible condition. At this time also, snow-melting equipment of whatever type is in use, should be put in position for immediate use when needed. All sections should be provided with a supply of salt for use around switches and on station platforms.

In making final plans for contending with snow during the winter, the local maintenance officers should make such arrangements as local conditions demand, to insure the availability of extra forces so that they may readily be organized at the beginning of any serious storm.

### This Is a Real Snow Country

By ROY W. PUTNAM
Roadmaster, Southern Pacific, Oakridge, Ore.

My territory lies in the Cascade mountains where snow becomes a serious problem, since it frequently reaches a depth of 15 ft. on the level, and is rather wet and heavy. Deep cuts and steep mountain slopes make avalanches and drifting snow a peril. During the past summer we have been engaged in widening the outer shoulder on side-hill cuts to permit the track to be thrown away from the side hill. This permits a spreader to be used to advantage in plowing the snow away from the track after a flanger has thrown it out.

Late in the fall our forces remove all obstructions that might interfere with this operation, including rocks, signs, track material, accumulations of dirt, and leveling off any extra ballast. The ballast in cribs through switches and frogs is lowered three to four inches. A special inspection is made to discover and remove rails that show signs of possible failure, to avoid the necessity of removing them during storms. Snow equipment, including rotary plows, flangers and spreaders, is overhauled to insure their fitness for winter work.

An important precaution in fighting snow is to have information on the snow conditions at all points. For this reason, we establish patrols on sections where we have experienced or expect particularly difficult or dangerous conditions. Telephone booths are placed at convenient points to permit the patrolmen to keep in touch with the dispatchers. Stoves and fuel are provided in the booths for the relief of the men during the intervals of their patrol.

Small tools, such as shovels, brooms, etc., are distributed and salt for switches is stored at convenient points. A supply of rails is placed on racks at frequent intervals at points where it will not be necessary to dig through several feet of snow to get at it. Bolts, angle bars, spikes, tie plugs, tie plates, oak shims, etc., are placed under cover at points where they will be readily accessible. These preparations are of major importance, since if one is ready when a storm breaks, the battle is half won. Conversely, without adequate preparation, the fight is a losing one from the start. Preparedness is essential to success in any emergency.

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## Pile Penetration Records

*Should penetration records be kept for piling? What are the advantages? Do these differ for foundation piles and piles in trestles* ?

### Such Records Save Later Waste of Material

By L. G. BYRD
Bridge and Building Supervisor, Missouri Pacific, Poplar Bluff, Mo.

My experience indicates that there is a marked economic advantage in reliable records of pile penetrations for both trestles and foundations. This applies to concrete as well as wooden piles. In other words, where reliable penetration records are not available, the way is open to a definite loss of both material and labor. Lack of such records may result in the driving of piling that are too short, and of settlement in the trestle or foundation, a situation that is not altogether unknown. On the other hand, incomplete or inaccurate information may cause the purchase of piles that are longer than necessary and result in either overdriving or a waste of both material and labor.

Penetration records should be kept for every pile driven, not only from the standpoint of economy, but as a safety measure. Knowledge of the carrying capacity of the piles, the amount of penetration and the character of the soil through which they are driven becomes particularly valuable in the case of scouring streams, during freshets or continued high water. Floods often occur on short notice, stream velocities may be high and the natural scour be accentuated by accumulated drift or ice. In such cases, the taking of soundings is of no value without a knowledge of the depth to which the piles in the structure were driven originally. Without this information, therefore, the safety of the structure cannot be determined.

### Have Current As Well As Future Value

By A. B. SCOWDEN
General Bridge Inspector, Baltimore & Ohio, Cincinnati, Ohio

Adequate pile penetration records give valuable information as to foundation conditions, not only in connection with future reconstruction, but also for investigations with respect to permissible loadings during the life of the structure. Questions continually arise concerning increased loadings which can be readily answered for the accessible parts of structures, but without proper information as to the foundation, the parts below ground must remain uncertain factors. The records should show, therefore, not only the final

depth of every pile, but also the penetration in the last 10, 20 or other definite number of blows; and should include hammer data to enable the engineer to compute the bearing capacity of the piles. This applies equally to trestles and foundations.

In trestle construction, or elsewhere where future rebuilding must be considered, it is desirable, in addition, that occasional information be inserted in the record, giving the actual penetration of a pile for each successive 50 or 100 blows. This permits one to determine whether the supporting capacity of the pile is due to accumulated skin friction or to a hard and unyielding stratum at the end of the pile.

For these reasons, the record taken in the field should state the character of the hammer, the weight of the moving part, the length of stroke or drop, and the steam pressure if the hammer is double-acting. For each pile, the information should include the length of the pile before driving, the length of the cut-off portion, the distance from ground line to cut-off and the penetration under the final 10 blows.

A remarks column should be provided for recording additional pertinent information, the gradual penetration of occasional piles and for noting any unusual conditions that may develop. The original field notes should be preserved as a part of the final record of the structure.

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# Inspecting Ties

*When inspecting ties for renewal, should they be selected according to a single standard or, if part of the track is to be raised out of face, to more than one standard? Why? If to more than one, how is each determined* ?

## Makes Renewal on Five-Year Basis

By H. F. FIFIELD

Engineer Maintenance of Way, Boston & Maine, Boston, Mass.

It is our practice to have supervisors inspect and mark with yellow paint every tie to be taken out during the following year. When stone ballast is installed, we renew all ties that are unsuited for satisfactory service for a period of five years, even though the track is to be resurfaced the year following the ballasting. On gravel track the spotting is done on an annual basis. We have demonstrated clearly that it is possible to make an attractive saving over a five-year period in the cost of maintaining track on stone ballast by so arranging that the track is not disturbed every year to install ties.

## Single Standard Is Seldom Practicable

By S. E. SHOUP

Assistant Engineer, Kansas City Southern, Kansas City, Mo.

A single standard for spotting ties for renewal is rarely practicable, even where the track is not to be raised out of face. Even with the improved rail joints of the present, a joint tie cannot be judged by the same standard as an intermediate tie. A doubtful tie between two good ones may be left in place, whereas if the ties on both sides are old and weakened, the replacing of the center tie may produce more service life from the ties on each side. With these modifications, where the ties are spotted in without a raise, all ties that will not give one year's satisfactory service should be replaced.

After track has been raised out of face, it is desirable to leave it undisturbed as long as possible, and good ties will contribute to this end. It is difficult to reduce the saving that will result to dollars and cents because of the many involved conditions and secondary factors, but, in general, a reduction of one or two men on a section for one to three years is practicable.

Neglecting the saving from reducing the forces, it can be shown that in actual tie cost it is economical to conform to a higher standard of replacements where track is raised out of face. The cost of spotting in a tie approximates 30 cents. Assume that the tie costs $1 and will have a life of 20 years. The cost in place is $1.30, which at six per cent makes the annual cost over its life $0.143. When the track is skeletonized, the cost of insertion is not more than 15 cents; the total cost is $1.15; and the annual cost $0.127. This difference in annual cost aggregates $0.32 during the life of the tie, so that it is an even break from the monetary standpoint if all ties are replaced that will not have a satisfactory service life exceeding 2¼ years.

## Should Get Full Tie Life

By H. S. TALLMAN

Supervisor of Track, Chesapeake & Ohio, Thurmond, W. Va.

Ties should not be renewed until they can no longer support the rail or hold it to gage. On curves, ties that are apparently sound frequently become unable to hold the gage because of excessive spiking. Often, if such ties, assuming that they are treated, are removed and installed in tangent track, they will last for many years, while the reduced cost of gaging by reason of the new ties will more than offset the cost of making the change. This is an example of a double standard of tie renewal.

On the other hand, a double standard should not be applied because the track is to be raised out of face. A bad tie is a bad tie, which statement is not connected with any other fact except that its renewal is necessary. Ties should remain in the track as long as they are able to do their share in supporting the track, except in street crossings, through station grounds and other places where costs of renewal are excessive.

## Thinks a Single Standard Justified

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Since ties constitute the largest single item of maintenance expense, it is obvious that they afford a large field for the exercise of economy. For this reason it is elementary that, in general, ties should not be removed from the track until they have deteriorated to the point where they can no longer function satisfactorily. There are, however, many other factors that affect the economical use of ties, so that while the foregoing statement is basic, it is often necessary to modify it, an example being through certain types of permanent crossings, where the cost of renewal is so high that it is more economical to renew all ties each time a renewal is required, even though many of them may have several years of satisfactory service life remaining.

Where treated ties have been in use for a considerable time and the track has been well maintained, the annual renewals per mile or per rail should be low as compared with former times when all ties were untreated. There is a definite advantage in allowing track to remain undisturbed as long as possible after it has been given a general raise. For this reason, while I would still apply a single standard to the inspection of ties in track that is to be raised, I would be slightly more liberal in my interpretation of the term "doubtful" as applied to the ties

that are under scrutiny. I do not mean to imply, however, that I would spot for renewal ties that clearly have two or more years of service life remaining.

Where the general tie condition is good, it is seldom detrimental to the track, except perhaps at joints, to allow "doubtful" ties to remain, provided the ties on either side are sound. If the tie in question is obviously unable to perform its functions, it should come out, and the fact that the track is to be raised should have no bearing on the decision.

I do not wish to be misunderstood. I believe in strong safe track at all times. On the other hand, there are so many opportunities for wasteful practices in the use of ties that I feel strongly that there should be a definite limit on their removal as long as there is any question as to the service they can continue to give.

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## Service and Fire Pumps

*What is the difference between a service pump and a fire pump? Can the former be used for fire purposes? If not, why* ?

### Fire Pumps Have High Reliability

By J. H. DAVIDSON

Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

In railway service the term "service pump" applies to any pump used to supply water for routine purposes to the various facilities at water stations or terminals. Since local conditions determine the type and capacity of the pump best adapted to meet the demands of volume and pressure, service pumps vary greatly in design and capacity. Where operating conditions permit, medium and low-pressure pumps are usually installed, rather than high-pressure pumps, since the first cost and the operating and maintenance expenses of the low-pressure type are less than for those operating at higher pressures.

Fire pumps are installed to pump water for fire protection. It is essential that such pumps be reliable. Accordingly, the National Board of Fire Underwriters had prepared specifications for fire pumps, which require many refinements, especially in fittings and appurtenances, such as gages, relief valves, hose outlets, etc., which are not usually found on general service pumps. For these reasons, it can readily be seen that the type of pump usually installed as a general-service unit will not meet the exacting requirements demanded of a fire pump and it should not, therefore, be used as one.

One of the specific requirements of the Underwriters is that fire pumps shall not be used for any other purpose. If a fire pump is used regularly for general service, it is quite likely that it may become worn and out of adjustment to the extent that its efficiency will be seriously decreased when an emergency arises.

### There Is Little Difference in Design

By C. R. KNOWLES

Superintendent Water Service, Illinois Central, Chicago

Any pump used in fighting fire must deliver the required amount of water at the desired pressure. If a service pump will meet these requirements, it will be quite as satisfactory in fighting fire as a standard fire pump. On the other hand, through the necessity for having dependable equipment of ample capacity ready for immediate operation when a fire breaks out, certain standards have been set up to cover pumps for fire-fighting service. Commercial pumps, of both the duplex-reciprocating and centrifugal types, intended for general service, are of many types and design. Some of them are weak in construction details; some have inadequate water passages; and others have working parts that are made of easily corroded materials. This latter feature is especially important since a fire pump may remain idle most of the time, and if the parts become corroded, the pump may be inoperative at the moment the fire breaks out. Another important detail is that fire pumps must be designed for quick priming, a feature that many ordinary service pumps do not possess.

There is little difference, however, in the general design of fire and service pumps. This applies to both the duplex steam fire pump and the motor-driven centrifugal type. Steam fire pumps conforming to the Underwriters' standard are merely pumps of the duplex type, substantially constructed with certain additions required by the Underwriters. The principal points of difference are that the internal working parts of the fire pumps are constructed of non-corrosive materials. For example, the piston and valve rods are of Tobin bronze instead of steel, while the water pistons and packing glands are brass instead of cast iron. Reciprocating fire pumps also have vacuum chambers, pipes, capacity plates and relief-valve discharge cones. The steam ports, water passages and air chambers are, in general, larger than those ordinarily provided for service pumps. Centrifugal fire pumps also have all working parts that are subject to corrosion constructed of non-corrodible material. They are provided with special fittings, pressure and vacuum gages, hose valves, capacity plates, etc., as are the steam pumps.

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## Bridge Inspection

*Where bridge inspections are made monthly by the divisions, are there any advantages in supplementing these inspections by less frequent inspections by system inspectors? If so, what are they* ?

### The Advantages Are Obvious

By BRIDGE ENGINEER

Division bridge inspections, made preferably at regular monthly intervals, are necessary, since the officers directly responsible for maintenance must have current knowledge of the condition of their structures if they are to maintain them properly. This includes culverts of all classes, trestles and steel bridges. In general, no division has a sufficient number of steel bridges to warrant the full-time employment of an inspector who is qualified to make a thorough inspection and pass on the condition of structural steel spans.

It is not debatable that steel spans stand in need of inspection the same as other structures, although, in general, they do not require detailed inspection with the same frequence. This lends itself to the system implied in the question. A division bridge inspector should be able to detect any serious or unusual conditions in steel spans or their substructures. He should, therefore, inspect all such bridges and report on them monthly.

Bridge engineers generally assume a larger measure of responsibility for the maintenance of steel bridges

than for other structures. It is logical, therefore, that structural steel inspectors be on the bridge engineer's staff and report to him. The territory assigned to each inspector should be selected to permit him to see every structure at the desired intervals, say two or more times a year, and to make one inspection a year in company with the division officers, in which should be included all bridges and culverts. Such a system has obvious advantages in that the local officers have current information on conditions, and through his inspectors the bridge engineer is in constant touch with those structures for which he assumes responsibility.

### Thinks Division Inspections Sufficient

By DIVISION ENGINEER

Every division should have a bridge inspector, whether specially assigned or taken from a gang as needed, who is qualified to inspect the structures on that territory. He should make a monthly inspection and several times a year, say quarterly, the bridge and building supervisor should accompany him. Bridge supervisors should be expert enough to detect defects in any type of structure and know what repairs are needed. If they are of such a character that he is unable to make them with the equipment he has available, he should report at once to the bridge engineer, asking his assistance. I am convinced, and this is confirmed by experience, that such a system is practicable, and that the duplication of effort in overlapping inspections is unnecessary. An advantage of this method is that the officers directly responsible for maintenance know at all times the condition of all of their structures and it is easy to place the responsibility for failure to take action when defects occur.

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## Placing Downspouts

*Is the advantage of better appearance sufficient to warrant the placing of downspouts in the walls of passenger stations instead of exposing them? If so, how should this be done? What material should be used? What should be the minimum diameter? Are there any disadvantages?* ?

### Determined by Type of Building

By FRANK R. JUDD

Engineer of Buildings, Illinois Central, Chicago

In general, the average passenger station does not require or warrant the concealing of the downspouts. As a matter of fact, the design of the building determines to a certain extent which type of downspout should be used or which is best adapted for the structure under consideration. Original cost also enters as a factor in making this determination. As a further general statement, structures having gable or hip roofs with wide projecting eaves call for exposed or hanging gutters and exposed downspouts. On the other hand, structures designed with either gable, hip or flat roofs, but with parapet walls, call for concealed downspouts. Those having box or concealed gutters may call for either exposed or concealed downspouts, depending on the design.

Where concealed downspouts are used, either cast-iron soil pipe, threaded cast-iron pipe or galvanized genuine wrought-iron pipe should be used with some type of roof drain. Concealed downspouts are usually placed in chases in the inside face of walls, with the interior finish concealing the chases. Sizes of downspouts are determined by the areas to be drained but in no case should they be less than four inches in diameter. They have the disadvantage that they are not as easily accessible as exposed downspouts. When repairs or replacements become necessary, it is often necessary to break through the interior finish over the chases, whereas the exposed downspouts are readily accessible and less expensive to repair.

### Appearance Seldom Considered

By J. W. ORROCK

Engineer of Buildings, Canadian Pacific, Montreal, Que.

I believe that appearance is seldom considered in selecting the type of downspout for passenger stations, convenience, cost and the type of roof generally being the governing factors. In general, flat roofs have concealed downspouts and sloping roofs have the downspouts outside. In cold climates there is more trouble with exposed downspouts from the formation of ice during thawing and freezing, than with those that are concealed. For this reason, many stations having sloping roofs have no downspouts, the drip being permitted to run over the eaves. With flat roofs, downspouts are seldom omitted. With this type they are brought down either next to the exterior walls or on the interior columns and are usually of cast iron.

Exposed downspouts are generally of copper, galvanized iron or other sheet metal and may be either round or square in section. The square section is more flexible than the round section and does not split as easily when ice bound or from the expanding ice during the melting period.

Concealed downspouts are expensive when applied to sloping roofs, especially in severe climates where they may freeze. In this case the ice problem is transferred to the inside of the structure, the solution being made more difficult when ice forms at the entrance to the spouts. The minimum dimension should be four inches whether the pipe is square or round.

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## Loose Track Bolts

*What causes track bolts to become loose? Can this be prevented? If so, how* ?

### Three Causes Contribute to Loosen Bolts

By A. N. REECE

Chief Engineer, Kansas City Southern, Kansas City, Mo.

Track bolts tend to become loose in service as a result of three contributing causes. The first, but probably the least important of these, is the backing off of the nut as a result of bolt tension and of vibration under trains; the second is the stretching of the bolts under tension, which may be augmented by impact at the joint; while the third is the wear on the fishing surfaces which allows the bars to come closer together, thereby reducing the bolt tension.

Specifications in general use for track bolts require a wrench-turn fit of the nuts, and this is effective in preventing nuts from backing off in service. Bolts are now generally heat treated, which materially improves their strength and resistance to stretching. Wear on the fishing surfaces is a relatively slow process, and periodic tightening of the bolts once or twice

a year will provide a satisfactory condition of joint maintenance. Spring washers are of value in preventing nuts from backing off and in absorbing impact shocks. In addition, spring washers possess a reactive strength which tends to maintain bolt tension, even where there is a certain amount of backing off of the nut, bolt stretching or wear on the fishing surfaces. Special locking threads have also been developed which permit the nut to be tightened, but wedge themselves so that backing off or loosening of the nut is prevented.

## Many Factors Combine to Loosen Bolts

By J. R. WATT
Engineer Maintenance of Way, Louisville & Nashville, Louisville, Ky.

Where rolled threads are used, I believe that the loosening of track bolts arises almost entirely from causes other than the backing off of the nut. I would say that there is probably some stretch of the bolt and a seating of the various parts of the joint assembly. New rails, splices, bolts and nut locks have burrs, scale and other obstructions to a proper fit. In service, all of the surfaces come to a bearing and some wear occurs between the bearing surfaces of rails and splices, all of which is evidenced by the loosening of the bolts Stretch in bolts can be overcome, but some take-up is necessary to provide for the seating and wear of the various surface.

## Loose Bolts Result in a Vicious Circle

By H. S. TALLMAN
Supervisor of Track, Chesapeake & Ohio, Thurmond, W. Va.

Since the joint between two abutting rails has less strength than the rail itself, it is logical that the stresses created by a given loading will have a greater adverse effect than in the remainder of the rail. This effect is increased by the blow delivered by the wheels as they pass across the expansion gap between the rails. Practice has demonstrated that well-tightened bolts are a definite aid in supporting the rail ends and in increasing the strength of the joint. For this reason, the necessity for keeping bolts tight cannot be over emphasized.

In view of the foregoing statement it may sound like a contradiction to say that track bolts can be kept too tight, yet this is true, and when this is done the results may be as bad as if they are not kept properly tightened. While we are under the necessity of keeping bolts tightened if the rail is to be given maximum support at the joint, we are also confronted with the practical necessity for allowing it to move freely between the joint bars as it expands and contracts under temperature changes. If we do not make provision for this movement, we can expect buckled track during hot weather. At low temperature, the pull exerted by the rail in contracting will eventually find a joint less tightly bolted than the others, and a wide gap and sheared bolts will be the result.

Loose bolts on newly laid rail are often due to neglect to follow up the first tightening with a second or even a third tightening. When either new or released rail is laid it is impracticable fully to seat the joint bars. As traffic passes over the rail, however, scale, rust and other obstructions to a proper fit are loosened and the joint bars can be moved in to be fully seated. At this stage the stress on the bolts is so reduced that if they are not again tightened they soon become loose, a condition more common than it should be.

During the passage of wheels over the joint a certain amount of wear takes place on all surfaces of the joint assembly that are in contact with other surfaces. As this wear increases, the effect of the blow delivered by the wheels is augmented, the rate of wear is increased and the joint eventually becomes low, the effect of the blows being transmitted to the ties and ballast. As this occurs, the vertical movement of the rail and joint bars, since they are not of the same amplitude, loosens the bolts. As the tension on the bolts decreases, the relative movement of the rails and bars becomes greater and the whole vicious cycle is repeated.

Other results that follow directly from these conditions are end flow of metal, battered joints, damaged ties and bent rail ends. While some or all of these defects occur, even where maintenance is to a high standard, the rate at which they progress is more rapid if the bolts are not kept properly tightened. As these defects progress, they increase the tendency of the bolts to loosen. The most practicable method of minimizing all of these forms of damage is to keep the ballast free-draining, the joints well-tamped to surface and the track lined. It is also helpful to keep the rail ends to good surface by welding, as flow, batter or chipping develops, since this will minimize the magnitude of the blows by the wheels.

Movements of the rails in expansion and contraction also operate to loosen track bolts. While this cause cannot be eliminated, its effects can be minimized by adequate applications of anti-creepers.

## Condition Does Not Arise from a Single Cause

By ROBERT WHITE
Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

A volume would be required to discuss in detail all of the causes of loose bolts and their correction. While these causes include improper design of the rail and the joint bars, from the trackman's point of view poor surface, battered joints, failure to tighten the bolts properly in the first instance, neglect to follow the first tightening with similar attention later and frequently poor material are only a few of the reasons why bolts continue to work loose. Yet when all of these causes are eliminated, the bolts still become loose. There must be, therefore, certain other causes which have not been mentioned. Observation and experience indicate two major causes, vibration and too much tension. If a poor design or grade of spring washer is applied to the joint, it does not have sufficient power to cushion the vibration set up by the wheels as they pass over the expansion gap between the rail ends. Neither do they take up the slack which results from wear, stretch of the bolt or backward movement of the nut. This slack increases until the washer no longer functions and the bolt is loose.

Over tightening of the bolt invariably does one of two things,—the bolt is stretched or the threads are damaged. In either case the bolt soon becomes loose. Loose bolts can be reduced to a minimum, but not prevented entirely. If bolts of proper grade are furnished and care is exercised in tightening them, only a minimum number will become loose. I have observed that even on the best-maintained roads, one can always find loose bolts if he looks for them.

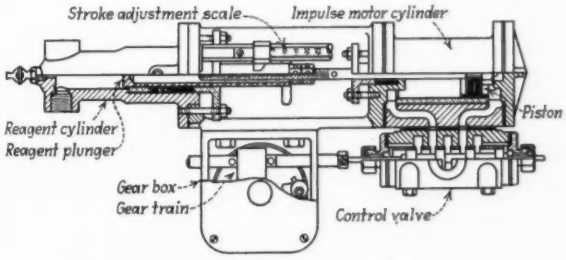
[Replies to this question were also received from W. H. Sparks, general inspector of track, Chesapeake & Ohio; L. G. Byrd, bridge and building supervisor, Missouri Pacific; and W. E. Tillett, assistant foreman, Chesapeake & Ohio. A further discussion of this subject by C. H. R. Howe, cost engineer, Chesapeake & Ohio, will also be found on page 552 of this issue.—Editor.]

# New and Improved Devices

## Dearborn Develops New Chemical Proportioning Device

THE Dearborn Chemical Company, Chicago, has developed a new type of chemical proportioning device for use in water treatment, known as the Tret-O-Unit, which has as its principal feature the use of outside power for the operation of the chemical pump, the force of the water in the pipe line being used merely to actuate the valves of an impulse motor which in turn operates the chemical pump.

The chemical feed of the device is essentially a reciprocating pump that is driven in tandem by a piston similar




Drawing Showing a Part Section of the Tret-O-Unit

to that of any steam pump, which may be actuated by either compressed air, steam or water power. The actuating substance is admitted to the cylinder through a balanced spool-type piston valve which is operated through a gear train by the rotating element of a flow-responsive device situated in the pipe line, this arrangement being so synchronized that the chemical feed is always directly proportional to the water flow.

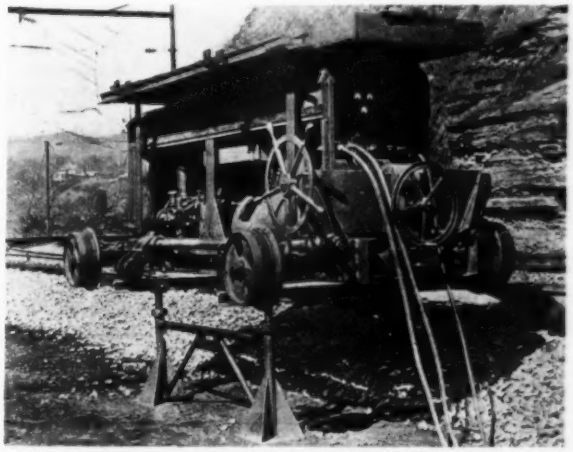
By means of a lug sliding on a stroke adjustment scale situated between the impulse motor and the chemical pump, the stroke of the chemical pump is adjustable up to four inches. In addition, if for any reason it is desired to change the stroking rate of the pump, this may be done by installing a gear-train plate of higher or lower ratio as the case may be. Moreover, a higher or lower stroking force may be readily obtained by the installation of an impulse motor of the necessary size to meet the particular requirements.

Three types of flow-responsive control are available with the Tret-O-Unit, which are known as the Tret-O-Meter, the Tret-O-Rotor and the Tret-O-Motor. The first of these is used where the water to be treated is free from sand, acids and abrasives, and is particularly adaptable for low and tapering flows and low shut-off points. The Tret-O-Rotor is adaptable to conditions in which the range between high and low flows is not great and is said to be able to handle water that would be destructive to a meter. The Tret-O-Motor is used in connection with reciprocating boiler-feed or deep-well pumps.

One of the principal advantages claimed for the Tret-O-Unit is that, because of the indirect method of control involved, the amount of chemical injected into the pipe line is said to be strictly proportionate to the rate of flow of the raw water, regardless of the rate of discharge. The accuracy of proportioning is said to be substantially the same at minimum flows as at normal or maximum rates of discharge.

## New Derailing Equipment on Westinghouse Welders

THE Westinghouse Electric & Manufacturing Company is now furnishing its self-propelled, rail car-mounted FlexArc welding machines with a new type of derailing device, designed to simplify the derailing operation when the unit is used along the track for building up battered rail ends or for making repairs to frogs, switches and crossings. The new device consists of four



One of the Westinghouse Car-Mounted Welding Generators Equipped With The New Derailing Equipment

double-flanged wheels, two on each side of the car, which are mounted at the ends of short arms, which in turn, are keyed to an operating shaft. By means of a hand wheel at the rear of the welder, operating through self-locking gears, the four double-flanged wheels can be swung through a short arc, outward and upward to clear for normal movement of the unit on the track, and downward and inward to a bearing on light transverse rails set on the track, such that the entire unit is lifted free of

the running rails. In this position the welding machine can be pushed sidewise from the track to a portable rail-stand.

The rail-stand furnished, consists of a variable-height standard to support the outer ends of two light transverse rails, and the two light rails themselves, which are fitted with built-up web footings at their inner ends to afford adequate support on the ties. The rail-supporting standard consists essentially of two spread-footed screw jacks, operated by hand independently, but joined together by steel tubing.

The welding unit shown in the accompanying illustration has a constant-current FlexArc 300-ampere welding generator and an auxiliary generator rated at 7½ kw., 125 volts, which are driven by a six-cylinder gasoline engine. This model, unlike past models, has all controls mounted on a panel at the rear, where they are readily accessible to the operator, and where they can be closed in readily by a sliding cover, which can be locked.

## New Heat-Treated Rail Crossings

THE Bethlehem Steel Company is now introducing a specially heat-treated rail crossing of the bolted rail type, which is claimed to out-wear solid manganese steel crossings under the same service conditions and, by reason of the greater resilience of its bolted construction, is said to produce smoother riding with less damage to it and to train service equipment.

In support of these claims, the service record of three heat-treated crossings installed on the Boston & Maine is cited, where, under the same physical conditions and subject to practically the same character and amount of traffic, the heat-treated crossings, in a period of two years, showed only about one-half as much wear and batter as solid manganese crossings. In this installation, which is at the extreme north end of the approach to the North Station terminal layout at Boston, nine diamond crossings are formed by a single-track crossing two enginehouse leads, the six main tracks of three of the four main-line divisions which enter the terminal, and a yard lead.

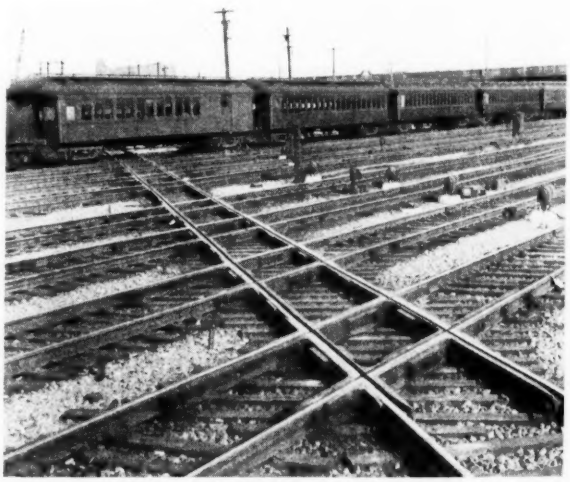
**Comparison of Physical Properties of Heat-Treated Steel in New Crossings and Standard Carbon-Steel Rail**

| | Bethlehem Heat-Treated Rail | Standard Carbon-Steel Rail |
|---|---|---|
| Elastic Limit | 126,700 lb. | 83,000 lb. |
| Tensible Strength | 177,400 lb. | 137,800 lb. |
| Elongation | 7.7 per cent | 8.8 per cent |
| Reduction in Area | 11.7 per cent | 12.1 per cent |
| Brinell Hardness | 361 | 282 |
| Izod Impact | 7 ft. lb. | 1 ft. lb. |

The angle of crossing is 40 deg. 46½ min. In this layout, three of the crossings are of the bolted rail type, fabricated throughout from specially heat-treated steel, while the other six are of solid manganese construction, and, more to the point, one of the crossings of the two main line tracks of each division is of the heat-treated type, while the other is of solid manganese. This arrangement was provided specifically to afford a direct comparison of the service life of the two types of crossings under similar traffic conditions.

In a further effort to insure an equitable comparison, an entirely new reinforced concrete foundation was provided beneath the crossings, built in accordance with A. R. E. A. recommendations of a series of 15-in. reinforced slabs laid side by side and supported on four inches of cinders. The trackwork above the slabs was placed on a layout of long treated ties placed diagonal to the crossing tracks and supported on 10 in. of crushed stone. Furthermore, the entire set of crossings was provided with subdrainage through the installation of perforated iron pipe placed in stone alongside and below the concrete slabs.

After two years of service, the Boston & Maine reports substantially less wear and batter of the heat-treated crossings than of the manganese crossings. In fact, the measurements made after this interval indicate that the average depth of depression of the points of the heat-treated crossings was only about one-half as much as that of all of the solid manganese crossings, being, specifically, 3.8 (+) thirty-seconds inch in the case of the heat-treated crossings, and 7.1 (—) thirty-seconds inch in the case of the manganese units. For the main line crossings only, the average of 3.8 (+) thirty-seconds inch depression of the three heat-treated units compares with an average depression of 7.9 (+) thirty-seconds inch at the points of the solid manganese crossings. In all cases, the depression at the points was measured on the rail treads ¾ in. back from the actual point of frog.



General View of the Test Installation of Heat-Treated and Solid Manganese Steel Crossings

Statistics of engine and car movements over the various crossings during the two years of test show that in spite of largely reduced wear and batter of the main-line heat-treated crossings, the traffic over them was considerably heavier than over the main-line solid manganese steel units. Specifically, 159,390 engines and tenders and 615,480 passenger cars passed over the heat-treated units, while only 134,550 engines and tenders and 462,300 passenger cars passed over the solid manganese units; in other words, 24,480 fewer engines and tenders and 153,180 fewer passenger cars passed over the manganese units.

There is little departure in the design of the heat-treated crossings from the standard bolted type, their increased wearing qualities being the result of the special heat-treating process to which they are subjected. An accompanying table shows a comparison of the tensile strength, Brinell hardness and other physical properties of the heat-treated crossings as compared with standard carbon-steel rail.

The solid manganese steel crossings in the Boston & Maine test, as well as the new heat-treated units, were furnished by the Bethlehem Steel Company.

# News of the Month . . .

## Failure to Find Broken Rails Means Prison to Soviets

Harsh penalties are meted out to employees of Soviet railroads, who have been convicted of inefficiency and laxity in the conduct of their duties. According to a recent press dispatch from Moscow, three officials and nine agents of the Moscow-Kursk Railway have been sentenced by a court to varying terms of imprisonment and forced labor because employees under their supervision failed to detect broken rails and defective ties and to improve the functioning of the railroad in general. A. N. Nevedrov, general manager, was sentenced to seven years in prison for inefficiency.

## Inland Waterways to Use Missouri River

The acting secretary of war, Harry H. Woodring, has approved a recommendation of Major General Lytle Brown, chief of engineers, that the Inland Waterways Corporation, the government owned barge line, begin preparations at once to put its boats in service on the Missouri river next spring and to make a survey of traffic, tariff arrangements and terminal facilities of this waterway as required by law. In accordance with the provisions of the Inland Waterways Corporation Act of 1924, the chief of engineers has certified that a sufficient and dependable channel, 6 ft. deep and 400 ft. wide, extending from the mouth of the Missouri to Kansas City, will have been completed by March 1, 1934, and with reasonable maintenance will be available on the average for 95 per cent of the time and at all times when the extreme low-water discharge of the river is reinforced by proper storage.

## Pennsylvania to Establish System Store-Door Service

System-wide store-door collection and delivery service for l. c. l. freight is to be established on the Pennsylvania, according to a statement issued recently by General W. W. Atterbury, president of this road. The plan outlined in the statement contemplates that the store-door service will be performed at the line-haul rates for l. c. l. moving distances up to and including 260 miles. The service will be optional, and freight eligible for collection and delivery at line-haul rates will be subject to minimum charges of 35 cents per 100 lb. or 50 cents for each individual shipment. For freight moving beyond 260 miles, store-door service will be available at a sliding scale of charges in addition to the station-to-station rates. Trucking arrangements will involve the employment of local trucking companies who will act as agents for the Pennsylvania. The establishment of this service, stated General Atterbury, "is a logical development of the position of our management that, in the public interest, rail and truck service should be brought into the closest co-ordination."

## General Ashburn Advocates Transport Co-ordination

The co-ordination of rail, water, highway and other forms of transportation into a national co-operative system, which would be governed by a reconstituted Interstate Commerce Commission was advocated by Major General T. O. Ashburn, president of the government-owned Inland Waterways Corporation, before a special session of the Rivers and Harbors Congress at Chicago on October 12-13. General Ashburn would reorganize the Interstate Commerce Commission by dividing it into groups "such as (1) the rail group, (2) the water group, (3) the motor group and (4) airways and pipe line group, for convenience called the 'miscellaneous group,' with each group handling matters pertaining only to the carriers under its jurisdiction." Citing the highly co-ordinated railway systems of the country, General Ashburn said that the logical method of procedure is to "bring about a co-ordinated system of water transportation and a co-ordinated system of motor transportation so that each may not only settle their own internecine strife, but be able to deal with their competitors on somewhat of an equality."

## Western Railroads Announce Lower Passenger Fares

Basic railway passenger fares will be reduced and the Pullman surcharge eliminated by railroads in the western district on December 1 for an experimental period of six months, as the result of action taken at meetings of the Western Association of Railway Executives and of the passenger traffic officers. The present basic passenger rate of 3.6 cents a mile is to be reduced to 3 cents per mile for one-way tickets, while round-trip fares with a 10-day return limit between all points in the West are to be based on a rate of 2 cents a mile with slightly higher fares for longer limits. Tickets based on these rates will be honored in all classes of equipment. In addition, a one-way coach rate of two cents a mile is to be established. This action has been taken after extended deliberation by the managements of the western lines and is being taken primarily as a measure that it is hoped will arrest the decline in railway passenger travel rather than as a means of actually increasing the revenues. Subsequent to the announcement of lower passenger fares by the western lines, executives of the eastern and southern carriers have held meetings to determine what action they should take under the circumstances. Their decision has been not to disturb existing basic passenger rates but to "make such special rates as will tend to attract an increased rail travel."

## To Study Labor Conditions in Truck Transportation

In co-operation with the section of research of the organization of the federal co-ordinator of transportation, the United States Bureau of Labor Statistics has undertaken a comprehensive study of the wages, hours and working conditions in the motor-truck transportation industry. The purpose is to supply the public with accurate information concerning employment in the trucking business and to furnish material for a part of the general investigation that is being made by the co-ordinator's organization on which recommendations for new transportation legislation are expected to be based. The information will be used in reaching conclusions as to the extent to which differences in the costs of rail and truck transportation are affected by the lower wages paid to truck employees and also in connection with a study of the relation between rates and costs of truck transportation.

## Railroad Man Elected to Head National Safety Council

John E. Long, superintendent of safety of the Delaware & Hudson, was elected president of the National Safety Council at the twenty-second annual safety congress and exposition, which was held at the Chicago on October 2-6. Mr. Long, who has been active in safety matters for many years, is the second railroad man to be elected to the presidency of this organization. He has been a member of the executive committee and of the board of directors of the National Safety Council since 1928. During 1928-29, he was chairman of the Steam Railroad Section of the council, and has also been chairman of the Safety Section of the American Railway Association. Mr. Long has been in railway service since 1901 when he became a telegrapher on the New York Central. In 1914 he went with the Canadian National as safety agent at Moncton, N. B., where he remained until 1918, when he was made superintendent of safety of the Delaware & Hudson.

## August Railway Net Far Above 1932

For August, the Class I railroads of the United States had a net railway operating income of $60,978,217, which represented an increase of $32,993,079, or 117 per cent, as compared with the corresponding month in 1932. Operating revenues in August totaled $297,017,776, as compared with $249,388,763 in August, 1932, an increase of 19.1 per cent. Operating expenses totaled $202,452,506, as against $187,646,631 in the same month of 1932, an increase of 7.9 per cent. For the first eight months of this year, the net railway operating income of these railroads was $277,666,122, as com-

pared with $148,885,399 in the same period of 1932, an increase of 87 per cent. Operating revenues for the eight months totaled $2,005,952,192, as compared with $2,068,090,684 in the comparable period of 1932, a decrease of 3 per cent. Operating expenses amounted to $1,466,302,314, compared with $1,644,345,288, a decrease of 10.8 per cent.

### Rail Employees In September Highest Since June, 1932

The number of employees of Class I railroads (excluding switching and terminal companies) as of the middle of the month of September was 1,030,090, the highest number for any month since June, 1932, and an increase of 35,460 employees, or 3.57 per cent, as compared with September, 1932, according to figures compiled by the Interstate Commerce Commission. The number of employees in September, 1933, also represented an increase of 15,211 as compared with August. The number of employees in the maintenance of way and structures group showed an increase of 5.42 per cent as compared with the number in September, 1932.

### August Freight Traffic 32 Per Cent Above 1932

The volume of freight traffic handled by the Class I railroads in August, measured in net ton-miles, showed an increase of 31.9 per cent above the same month in 1932, according to reports compiled by the Bureau of Railway Economics. Freight traffic in August amounted to 26,468,468,000 net ton-miles, as compared with 20,070,794,000 net ton-miles in August, 1932. Compared with the same month in 1931, however, the volume of freight traffic in August this year was a reduction of 2,892,929,000 net ton-miles, or 9.9 per cent. Freight traffic handled by the Class I railroads in the first eight months of 1933 amounted to 176,605,876,000 net ton-miles, an increase of 9,508,205,000 net ton-miles, or 5.7 per cent, over the corresponding period in 1932.

### Freight Surcharges Expire

The freight surcharges which have been in effect on all traffic except a list of specified commodities, largely agricultural products, by order of the Interstate Commerce Commission since January 4, 1932, expired on September 30. The surcharges, which ranged from six cents a ton to two cents a hundred pounds, were placed in effect by order of the commission in lieu of the 15 per cent general increase in freight rates asked by the railroads. According to the original order, they were to expire on March 31, 1933, but were extended an additional six months.

The commission originally estimated that the surcharges would produce $100,000,000 to $125,000,000 additional revenue but, because of the falling off in traffic and to delays in applying them in many states, they amounted only to about $75,000,000 up to March 31. These revenues were pooled by the Railroad Credit Corporation and loaned to companies requiring aid to meet fixed charges.

# Association News

### The Roadmasters' Association

Members of the Executive committee will meet in Chicago on November 3 to choose subjects and select the personnel of committees for the next year, the reports of existing committees having been printed in the October issue.

### Maintenance of Way Club of Chicago

E. J. Brown, roadmaster in the Chicago terminal district of the Chicago, Burlington & Quincy, was the speaker at the meeting held at the Auditorium Hotel on October 18, which followed a dinner served to 55 members and guests of the club. His subject was Track Maintenance in Terminals.

### International Railway Maintenance Club

The next meeting of the International Railway Maintenance Club will be held at the Statler Hotel, Buffalo, N. Y., on November 9. Following luncheon, which will be served at 12:30 E. S. T., the meeting will be addressed by J. J. Brinkworth, assistant superintendent of the New York Central at Buffalo, N. Y.

### The Wood-Preservers' Association

Members of the Executive committee met at the Union League Club, Chicago, on October 11 to transact routine business and especially to draft plans for the next annual convention which will be held in Houston, Tex., next January. The program was prepared tentatively and invitations are being extended to speakers selected.

### American Railway Engineering Association

The reports of two committees of the association, namely, the Special Committee on Stresses in Track and the Committee on Electricity have been completed and are already in the hands of Secretary E. H. Fritch. In the meantime, 15 other committees held meetings during the last month for the purpose of whipping their reports into final shape. Chicago was the place of meeting of 10 committees, namely, Standardization on October 5, Rail on October 7, Yards and Terminals on October 9 and 10, Wood Preservation on October 10, Wooden Bridges and Trestles on October 13, Maintenance of Way Work Equipment on October 18 and 19, Waterproofing on October 19 and 20, Masonry on October 25 and 26, and Signals and Interlocking, and Rules and Organization on October 27. The committees on Shops and Locomotive Terminals and on Buildings met at Cincinnati on October 17 and 18, and on October 24 and 25, respectively, the committees on Ballast and on Economics of Railway Location at Pittsburgh on October 5 and October 30, respectively, while the committee on Iron and Steel Structures met at Cleveland on October 5 and 6.

# Personal Mention

## General

**Norman B. Pitcairn,** president of the Detroit, Toledo & Ironton, whose railway service includes many years in the engineering and maintenance of way departments of the Pennsylvania, has been appointed co-receiver of the Wabash, with headquarters at St. Louis, Mo. Mr. Pitcairn was born on November 8, 1881, at Harrisburg, Pa., and received his higher education at Princeton university. He first entered railway service on June 29, 1901, as a rodman on the Pennsylvania, being promoted to transitman in 1904 and to assistant supervisor of track in 1905. Five years later he was further promoted

Norman B. Pitcairn

to supervisor of track and on November 10, 1919, he was appointed division engineer on the Pittsburgh division, being transferred to the Middle division in the following year and thence to the New York division in July, 1922. In October, 1923, Mr. Pitcairn was promoted to superintendent of the Erie & Ashtabula division, later serving in the same capacity on the Middle and the New York divisions. In July, 1928, he became general superintendent of the Eastern Ohio division, which position he held until January, 1931, when he was elected president of the Detroit, Toledo & Ironton (a subsidiary of the Pennsylvania), with headquarters at Dearborn, Mich.

**Stanley P. Ruddiman,** vice-president of the Detroit, Toledo & Ironton, and formerly chief engineer of this company, has been elected president, with headquarters at Dearborn, Mich. Mr. Ruddiman was born on November 23, 1890, at Detroit, Mich., and received his higher education at Vanderbilt university, from which he was graduated in 1913. Soon after leaving school, he entered the engineering department of the city of Opelousas, La., as resident engineer on the installation of a sewer system, after which he became connected with the city engineer's office at Birmingham, Ala. In 1915, Mr. Ruddiman became connected

with the Ford Motor Company at Detroit, and in 1921 he entered the service of the Detroit, Toledo & Ironton as chief engineer. In 1927 he was promoted to vice-president and general manager and in the

Stanley P. Ruddiman

following year he became president, holding this position until 1929, when he was made vice-president. Mr. Ruddiman retained the latter position until his recent election as president.

**M. W. Clement,** vice-president in charge of the operating department of the Pennsylvania and formerly a division engineer on this road, has been advanced to the position of vice-president of the company, with headquarters as before at Philadelphia, Pa. Mr. Clement was born on December 5, 1881, at Sunbury, Pa. He was educated at Trinity College, Hart-

M. W. Clement

ford, Conn., and entered the service of the Pennsylvania on August 1, 1901, as a rodman in the office of the principal assistant engineer of the United Railroads of New Jersey (now part of the Pennsylvania). He served successively as a transitman and assistant supervisor, and in January, 1910, was promoted to supervisor at Philadelphia. Mr. Clement was transferred to the Manhattan division in June, 1913, and to the Pittsburgh division in December, 1913. In December, 1914, he was promoted to division engineer of the New York, Philadelphia & Norfolk (part of the Pennsylvania), and in August, 1916, he returned to the Pennsylvania as division engineer to study improvements in and around New York. He became division engineer under the principal assistant engineer of the New Jersey division in November, 1916, and in June, 1917, he was made superintendent of the New York, Philadelphia & Norfolk. In September, 1918, he was promoted to superintendent of freight transportation of the Eastern Lines and four months later was appointed acting superintendent of passenger transportation. In March, 1920, he was appointed general superintendent of the Lake division, with headquarters at Cleveland, Ohio, retaining that position until March 1, 1923, when he was promoted to general manager of the Central region at Pittsburgh, Pa. Mr. Clement was advanced to the newly-created position of assistant vice-president in charge of operation, with headquarters at Philadelphia, in October, 1925, and in September, 1926, he was appointed vice-president in charge of operation, the position he held at the time of his recent appointment. In his new position, Mr. Clement will have general supervision, under the president, of all departments of the railroad.

## Engineering

**Paul X. Geary,** whose promotion to assistant division engineer on the Ft. Wayne division of the Pennsylvania, with headquarters at Ft. Wayne, Ind., was noted in the October issue, has been connected with the engineering department of the Pennsylvania for 20 years. He was born on March 29, 1891 at Wilkinsburg, Pa., and graduated from the University of Pittsburgh in 1913. In the same year, Mr. Geary entered the service of the Pennsylvania as a rodman on the Pittsburgh division, which position he held until June, 1917, when he was made a transitman at Broad Street station, Philadelphia, Pa. In October, 1917, he was further advanced to assistant supervisor of track, holding this position at various points. In August, 1923, Mr. Geary was promoted to supervisor of track, with headquarters at DuBois, Pa., and in February, 1927, he was appointed master carpenter of the Renovo division, with headquarters at Erie, Pa. In December, 1928, Mr. Geary was again appointed supervisor of track, this time on the New York division, with headquarters at New York, which position he was holding at the time of his recent promotion to assistant division engineer.

## Track

**R. V. Glover,** a member of the engineering corps of the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa., has been promoted to supervisor of track on the main line, Northern division, at Binghamton, N. Y., succeeding **J. H. Taylor,** who died on September 2.

**R. Rex,** assistant supervisor on the Indiana Harbor Belt (a subsidiary of the New York Central), with headquarters at Gibson, Ind., has been promoted to supervisor of track, with headquarters at Lyons, Ill., to succeed **C. L. Nolan,** who has been appointed assistant supervisor on the Chicago Junction and the Chicago River & Indiana. **Lawrence Livingston,** track foreman, has been promoted to assistant supervisor, with headquarters at Gibson, to succeed Mr. Rex.

**A. W. Tabert,** assistant roadmaster on the Chicago & North Western, with headquarters at Milwaukee, Wis., and until recently a roadmaster on the Madison division, has been appointed roadmaster on the Lake Shore division, with headquarters at Fond du Lac, Wis., succeeding **C. H. Staples,** whose death is noted elsewhere in these columns. **F. E. Schaumburg,** roadmaster on Subdivision No. 4 of the Eastern division, with headquarters at Norfolk, Neb., has been transferred to Subdivision No. 2 of the Galena division, with headquarters at West Chicago, Ill., to succeed **J. H. Bratton,** who has been transferred to Norfolk.

**F. W. Artois,** assistant supervisor on the Pennsylvania, with headquarters at New York, has been promoted to supervisor on the Wilkes-Barre division, with headquarters at Reading, Pa. **C. R. Bergman,** assistant supervisor on the Maryland division, has been promoted to supervisor, with headquarters at Williamsport, Pa., succeeding **J. L. Cranwell,** who has been transferred to East Liberty, Pa. **A. W. Miller** has been appointed assistant supervisor on the Delmarva division, with headquarters at Clayton, Del., to succeed **A. R. Mahaney,** who has been transferred to Lancaster, Pa. Mr. Mahaney replaces **W. H. Heims,** who has been appointed assistant supervisor, with headquarters at Wilmington, Del. **R. W. Speidel** has been appointed assistant supervisor on the Philadelphia division, with headquarters at Enola, Pa.

## Bridge and Building

**H. Callahan,** formerly supervisor of bridges and buildings on the Iowa division of the Illinois Central, with headquarters at Dubuque, Iowa, has been reappointed to that position, with headquarters at Ft. Dodge, Iowa, to succeed **J. R. Morphew,** who is off duty because of ill health.

## Obituary

**W. H. Gentle,** who retired in 1924 as master carpenter on the Chicago, Burlington & Quincy, with headquarters at Creston, Iowa, died on October 14 at that point at the age of 82 years.

**Arthur G. Baker,** who retired in 1916 as division engineer on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Lewistown, Mont., died at Los Angeles, Calif., on September 14. Mr. Baker had served in the engineering department of the Milwaukee for 48 years, largely as an assistant engineer and division engineer on location and construction. He was born at Cawnpore, India, on February 22, 1853, coming to this country at the age of 13, where he attended Rensselaer Polytechnic Institute, graduating with a degree in civil

engineering in 1876. He first entered the service of the Milwaukee in 1878, serving in various capacities in the engineering department until 1896 when he was advanced to assistant engineer. Six years later Mr. Baker was further promoted to division engineer, which position he held until his retirement in 1916. From 1902 to 1907, Mr. Baker was engaged in the task of locating a route to the Pacific Coast and later was in charge of the construction of that portion of the line between Marmarth, N. D., and Melstone, Mont., after which he supervised the location and construction of the Milwaukee's line between Lewistown, Mont., and Great Falls.

**G. W. Gray,** supervisor of maintenance of way equipment on the Central region of the Pennsylvania, with headquarters at Pittsburgh, Pa., died on August 12 at his home at Pittsburgh, after a relatively brief illness. Mr. Gray was 48 years of age and had 24 years' service with the Pennsylvania.

**C. H. Staples,** roadmaster on the Chicago & North Western, with headquarters at Fond du Lac, Wis., died on September 26. Mr. Staples had served in the engineering and maintenance of way departments of several railroads, in addition to engaging for a time in the railway supply business. He was born on May 31, 1890 at Elmira, N. Y., and graduated from Elmira Academy in 1909. His first railway service, which began on June 1, 1909, was with the Delaware, Lackawanna & Western as a trainman. Shortly thereafter he was transferred to the engineering department as a rodman, subsequently being promoted to instrumentman. Later, Mr. Staples accepted a similar position on the Erie, where he was promoted through the positions of chief of party, general foreman and supervisor of track. Next, he became connected with the O. F. Jordan Company in a sales capacity and after serving for a time with this company, he entered the service of the Chicago & North Western on April 2, 1928, as a general foreman, later being appointed instrumentman. On July 1, 1929, Mr. Staples was promoted to assistant roadmaster on the Galena division and in the spring of 1932, he was further advanced to roadmaster of the Fourth subdivision of the Lake Shore division, with headquarters at Fond du lac, the position he was holding at the time of his death.

**Kemper Peabody,** formerly general supervisor of buildings on the New York Central, Buffalo and East, who retired from active service on September 1, 1931, died on September 26, 1933, at his home at New Rochelle, N. Y. Mr. Peabody, who was born on August 2, 1861, at Plymouth, Wis., was educated in the public schools and at Shattuck Military school. His first railway service was with the Duluth & Iron Range from September, 1888, to June, 1889, as a rodman and transitman. From the latter date until January, 1891, he was employed in general construction and survey work in North Dakota, and was then elected to the state legislature, where he served until April, 1893. After leaving the legislature he became engaged in appraisal and surveying work for the U. S. government, but a short time later was appointed state bank examiner of North Dakota. After two years in this position he again engaged in appraisal and surveying work for the government, until April, 1897, when he went with the Chicago Great Western at Dubuque, Iowa, as a masonry inspector. In June, 1901, he entered the service of the New York Central as a building inspector, which position he held until January, 1909, when he was appointed assistant supervisor of buildings. In October, 1918, he was promoted to supervisor of piers and buildings, and in July, 1925, he was promoted to general supervisor of buildings, the position he was holding at the time of his retirement.

**Almon I. Gauthier,** assistant division engineer on the New Hampshire division of the Boston & Maine, with headquarters at Concord, N. H., died suddenly on October 17 of a cerebral hemorrhage. Mr. Gauthier was born on June 2, 1887, at Cornwall, Ont., and after receiving a high school and a preparatory school education, he entered the service of the

Almon I. Gauthier

Boston & Maine as a roadman in the engineering department in 1907. In December of that year he left the railroad, and for the next 15 months worked in the office of the city engineer of Lowell, Mass., as a rodman and transitman. On April 1, 1909, he returned to the Boston & Maine as a rodman in the construction department and was later advanced to transitman and to assistant engineer. In October, 1911, he was transferred to the bridge and building department as assistant supervisor of bridges and buildings on the W. N. & P. division, and on July 1, 1914, he was promoted to supervisor of bridges and buildings on the Terminal division, with headquarters at Boston, Mass. On January 15, 1915, he was transferred to the Southern division at Concord, N. H., and in April, 1930, was promoted to assistant division engineer with the same headquarters, the position he was holding at the time of his death. Mr. Gauthier had been active in the affairs of the American Bridge and Building Association and at the time of his death was first vice-president of this organization.

# Supply Trade News

## General

**A. C. Streamer,** sales manager of the diversified products division of the **Westinghouse Electric & Manufacturing Company,** has been appointed transportation sales manager, with headquarters at East Pittsburgh, Pa.

**W. K. Leach,** formerly with the General Alloys Company, Boston, Mass., has been appointed general manager of the Alloy division of the **American Manganese Steel Company,** with headquarters at St. Louis, Mo.

## Personal

**The Westinghouse Electric & Manufacturing Company, Westinghouse Electric International Company, Westinghouse Electric Elevator Company** and **Westinghouse Lamp Company** have moved their New York executive and sales offices to the RCA building, 30 Rockefeller Plaza, New York City.

**The American Rolling Mill Company,** Middletown, Ohio, has established a stainless steel sales department for the distribution of stainless steel sheets, strips and plates, which the company is now manufacturing, following experimental work on stainless steel alloys which has been in progress in the company's plants. **J. P. Butterfield,** manager of the Armco development department, has been placed in charge of the new department.

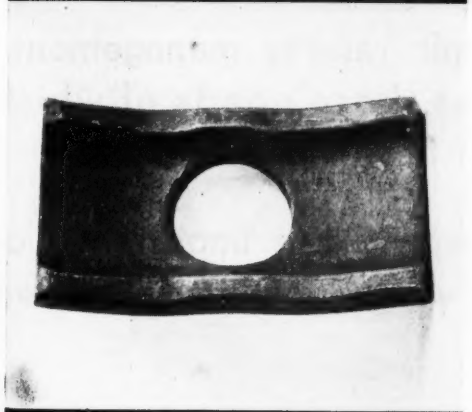
**Robert Gregg,** vice-president of the **Tennessee Coal, Iron & Railroad Company** (subsidiary of the United States Steel Corporation), has been elected president of the company, with headquarters at Birmingham, Ala., to succeed **Herbert C. Ryding,** who retired on October 15. Mr. Gregg was born 48 years ago at Atlanta, Ga. He attended Georgia School of Technology and graduated from Cornell university. He commenced his business career in August, 1907, with the Atlanta Steel Company of Alabama, remaining with that company and its successor until August, 1932, when he resigned to go with the Tennessee Coal, Iron & Railroad Company as vice-president.

Mr. Ryding was born at Lymington, Hampshire, England, receiving his university training at Heidelberg, Germany. He entered the steel industry with Townsend, Wood & Co., South Wales, and in 1885 came to America and was associated with A. J. Moxham, operating rolling mills at Birmingham and at Louisville. Mr. Ryding later was transferred to the Johnstown Steel Company, Johnstown, Pa., subsequently serving at Lorain, Ohio, as superintendent. In 1907 he went with the Tennessee Coal, Iron & Railroad Company as assistant to the vice-president, being advanced to the vice-presidency on June 1, 1917, and later to the presidency.

# WOODINGS-VERONA TOOL WORKS

VERONA, PENNA.

Since 1873



Winter and cold temperatures bring additional difficulties to track men.

Severe temperature drops frequently cause alarming conditions of running contraction of rail, resulting in broken bolts and rail connections pulled apart.

Running contraction and expansion are caused by irregular bolt tension.

**Verona Triflex Springs,** by their ability to indicate equal bolt tension to trackmen, offer you a remedy for this condition.

Besides, **Verona Triflex Springs** have a capacity $2\frac{1}{2}$ times the American Railway Engineering Association's specifications for spring washers.

# VERONA TRIFLEX SPRINGS

# What Are You Doing About It—

## Mr. Manufacturer?

Surveys show that the railways have deferred purchases totaling more than $600,000,000.

These deficiencies include more than $250,000,000 of maintenance of way materials and equipment.

As earnings permit, railway managements will first meet those needs of which they are most fully aware.

Are you emphasizing the importance of those needs which you are prepared to meet?

In other words, are you meeting the competition of other lines as well as of other companies in your own field?

The logical way to convey your message is through the advertising pages of

Railway Engineering and Maintenance

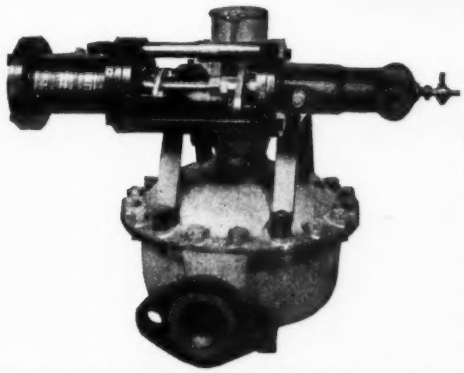
It reaches the men who are making the programs and selecting the materials and equipment.

**NOW IS THE TIME TO TELL YOUR STORY**

# Combined Field and Laboratory Service

## *A Modern Necessity in Efficient Boiler Operation*

**Dearborn**
TRADE MARK REGISTERED



DEARBORN CHEMICAL COMPANY have EXCLUSIVE Railway Sales Rights on TRET-O-UNIT EQUIPMENT in U. S. A., CANADA and MEXICO

Our water treating units include a full range of types, efficient, reliable and economical in railroad service. Operating conditions determine which of these units shall be employed in introducing Dearborn Treatment to water supplies. Inquiries invited.

A laboratory with nearly a half century of continuous research in correcting troublesome water conditions; a field service manned by experienced representatives who take pride in their responsibilities and in upholding the reputation of the name Dearborn. Here is an unbeatable combination in overcoming scale formation, foaming, pitting and corrosion in locomotive boilers.

This Dearborn service assures correctly treated boiler water at all times, and produces definite savings far in excess of its cost. Let us send a representative to discuss Dearborn Treatment with you and make a survey of your water conditions. Analyses and recommendations will be made without charge.

Address us at 310 South Michigan Avenue, Chicago; 205 East 42nd Street, New York; 2454 Dundas Street, W., Toronto.

NATIONAL RECOVERY ACT MEMBER NRA U.S. WE DO OUR PART

**DEARBORN CHEMICAL COMPANY**


STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of RAILWAY ENGINEERING AND MAINTENANCE, published monthly at Chicago, Ill., for October, 1933.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared Elmer T. Howson, who, having been duly sworn according to law, deposes and says that he is the editor of the RAILWAY ENGINEERING AND MAINTENANCE and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are:

Publisher, Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 105 West Adams St., Chicago, Ill.

Managing Editor, Walter S. Lacher, 105 West Adams St., Chicago, Ill.

Business Manager, F. C. Koch, 30 Church St., New York, N. Y.

2. That the owners are:

Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.; Simmons-Boardman Publishing Corporation, 30 Church St., New York, N. Y.; Stockholders of 1 per cent or more of the total amount of stock are: I. R. Simmons, 1625 Ditmas Ave., Brooklyn, N. Y.; Henry Lee, Hopatcong, N. J.; P. A. Lee, Hopatcong, N. J.; E. G. Wright, 398 N. Walnut St., E. Orange, N. J.; S. O. Dunn, 105 West Adams St., Chicago, Ill.; C. E. Dunn, 3500 Sheridan Rd., Chicago, Ill.; B. L. Johnson, 105 West Adams St., Chicago, Ill.; W. A. Radford, 407 So. Dearborn St., Chicago, Ill.; L. B. Sherman, 575 Sheridan Rd., Winnetka, Ill.; Mae E. Howson, 105 West Adams St., Chicago, Ill.; Frederick H. Thompson, 643 Terminal Tower, Cleveland, Ohio; Spencer, Trask & Company, 25 Broad St., New York, N. Y. Partners of Spencer, Trask & Company are: E. M. Bulkley, Acosta Nichols, Cecil Barret, C. Everett Bacon, William R. Basset, F. Malbone Blodget, Percival Gilbert, Harry S. Allen, Harry A. Minton, William Beckers, Arthur H. Gilbert, all of 25 Broad St., New York, N. Y.; William E. Stanwood, 50 Congress St., Boston, Mass.; John Nightingale, 50 Congress St., Boston, Mass.; and S. Bayard Colgate, Special Partner, 52 Wall St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

ELMER T. HOWSON,
Editor.

Sworn to and subscribed before me this 29th day of September, 1933.

ANNE A. BOYD.

[Seal] (My commission expires Dec. 10, 1935.)


# Remembered!

The recent upturn in business has brought us many substantial orders from railroads which did not have occasion to use Railroad Calcyanide during the more severe periods of the depression. Some of these orders are the first received in more than a year.

This is gratifying evidence of the lasting impressions which the remarkable efficiency of Railroad Calcyanide has created in the minds of railroad men.

Verily, quality is not easily forgotten.

***Write for booklet of instructions.***

**CALCYANIDE COMPANY**
HOME OFFICE
60 E. 42nd ST. NEW YORK CITY

**Distributors:**
KANSAS CITY, W. W. Hinds, 4013 Madison Ave.; SAN FRANCISCO, John F. Leinen Sanitation Co., 1337 Mission St.

## REPORT OF COMMITTEE

As reported in the October issue of this magazine, the Maintenance Committee of the Roadmasters and Maintenance of Way Association reports:

# "Batter *is largely a matter of* Maintenance"

*Discussion,* by Mr. J. A. Snyder (Roadmaster M C):

"A class of rail failure which should receive increased attention, especially from the economic standpoint, is the battered or chipped end."

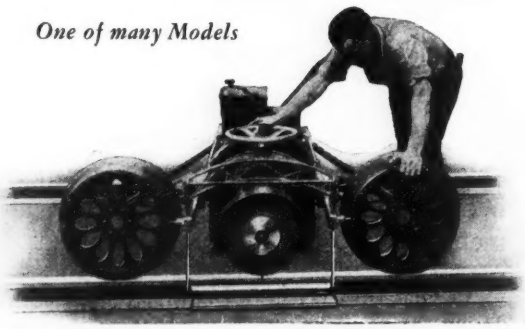
*Cure:* Welding and Grinding.

World's headquarters for rail grinders is ready to send you data on newest models. Write us.

**Railway Track-work Co.**

**3132-48 East Thompson Street, Philadelphia**

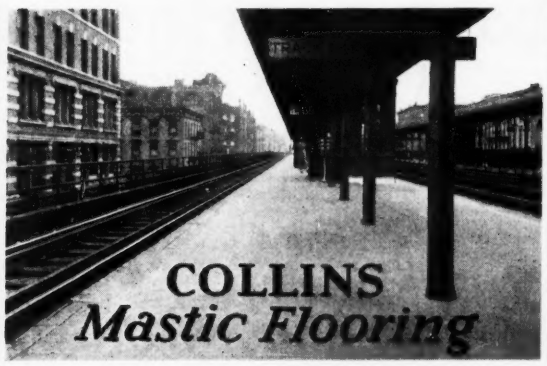
*One of many Models*



**Railway Track-work Company Portable Track Grinder, Model P-3**

Grinding wheel operates on either rail. Single throw hand lever operates a jack enabling operator to swing machine for grinding opposite rail. Grinds gauge line or outside of rail at 9500 surface ft. per min. Electric motor driven. Quickly adjusted roller permits speedy derailing. Model P-6 same as above except that it is operated by a gasoline engine.

154




*125th St. Passenger Station, New York, New York Central R. R.*

**Why Collins Asphalt Emulsions Are Particularly Adapted For All Uses**

**They are applied cold, eliminating all fire hazard and danger to workmen.**

**Applied easily, at less cost—no specially trained workmen are necessary.**

**Under average drying conditions they will dry in from 36 to 48 hours, according to the thickness of application.**

**Have a high degree of fire resistance.**

**Their use creates saving in labor and handling.**

**MALONEY OIL & MANUFACTURING CO.**
**75 West Street New York, N. Y.**
***Exclusive Railroad Sales Representatives The Headley Emulsions***


## Alphabetical Index To Advertisers


A
Air Reduction Sales Co. ..... 526
Armco Culvert Mfrs. Assn. ..... 528

B
Bethlehem Steel Co. ..... 532

C
Calcyanide Co. ..... 569

D
Dearborn Chemical Co. ..... 569

I
Ingot Iron Railway Products Co. ..... 528

L
Lundie Engineering Corp. ..... 527

M
Maloney Oil & Mfg. Co. ..... 570

N
Nordberg Mfg. Co. ..... 529

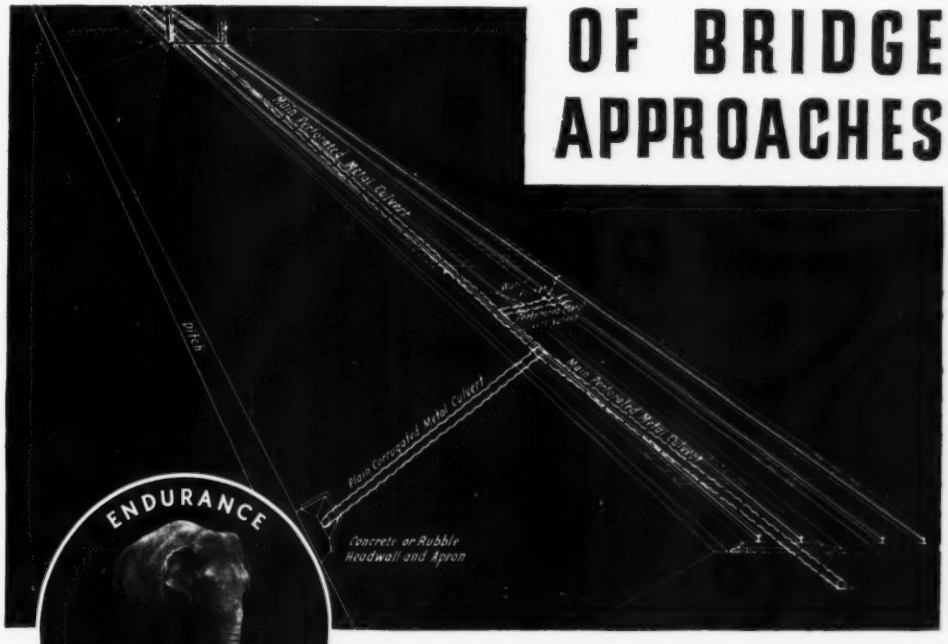
R
Railway Track-work Co. ..... 570
Ramapo Ajax Corp. ..... 534

S
Simmons-Boardman Publishing Co. ..... 525
Standard Oil Co. (Indiana) ..... 531

T
Timken Roller Bearing Co. ..... 572
Toncan Culvert Mfrs. Assn. ..... 571

W
Woodings-Verona Tool Works ..... 567

# ECONOMICAL DRAINAGE OF BRIDGE APPROACHES



● To insure uninterrupted movement of traffic, more than the usual precautions should be exercised in planning the drainage of bridge approaches—to provide adequate drainage—to insure long life of the structure.

Approaches are generally high fills and often quite long. Without correct drainage, rainfall saturates the roadbed and large deep water pockets form, causing caving and slides under heavy traffic, often interrupting service for long periods of time.

A system of drains should be placed to drain all pockets. Perforated Toncan Iron Culverts should be placed on crushed stone in a trench between the tracks. Laterals should be laid at intervals of about 50 feet, draining water pockets into the main. At intervals of 300 feet the main should be provided with outlets of Toncan Iron Culvert, not perforated, to carry the water to the ditch at ground level. Outlets should be provided with headwalls and aprons.

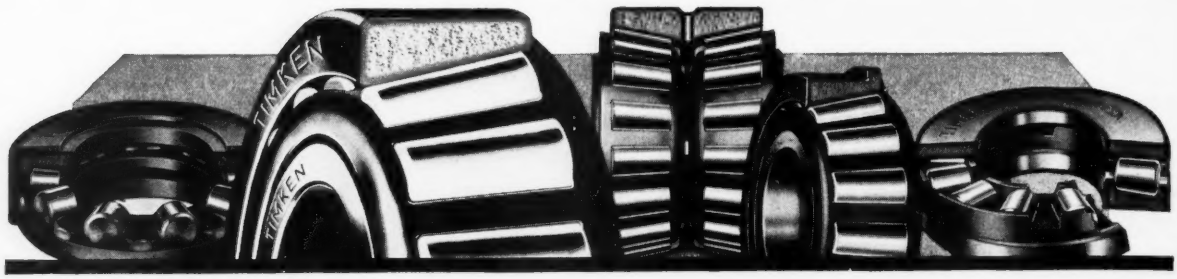
And be sure that the culverts you install in bridge approaches, where replacements are expensive, are of Toncan Copper Molybdenum Iron, the modern alloy that outlasts all other ferrous materials except the stainless steels—the alloy that costs less because it lasts longer.

Write today for a copy of the "Toncan Culvert Handbook" and "Handbook of Toncan Sectional Plate Pipe."

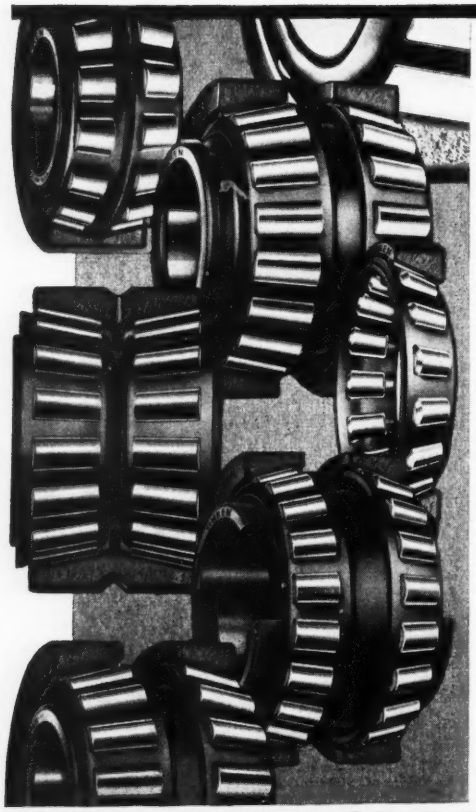
REG U.S. PAT. OFF.
TONCAN
COPPER MO-LYB-DEN-UM
IRON CULVERTS

**TONCAN CULVERT RAILWAY SALES**
310 South Michigan Avenue Chicago, Illinois

**TONCAN CULVERT MANUFACTURERS' ASSOCIATION • YOUNGSTOWN, OHIO**




# There Is a Type of Timken Bearing for Every Type of Railway Maintenance Equipment

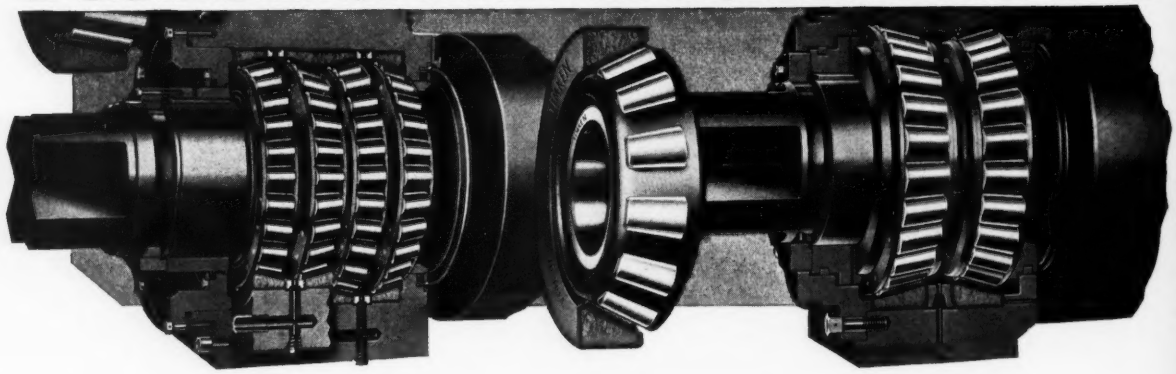


The standard type of Timken Tapered Roller Bearing provides the necessary qualities—including the correct proportion of radial and thrust load capacity—for the great majority of maintenance equipment applications. But every type of equipment has its own individual bearing requirements, and there is a type of Timken Bearing to meet *every one of them.*

So it is that you will find Timken tapered construction *specifically engineered* to provide the utmost in efficiency, economy, low maintenance and long life in section motor cars and trailers and other types of railway maintenance equipment.

That is one of the important reasons why the Timken Bearing has such an outstanding performance record and is overwhelmingly dominant throughout the railway field not only in maintenance equipment but also in passenger cars and locomotives.

When buying new equipment of any type it is long-run economy to specify "Timken Bearing Equipped".

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

**TIMKEN** *Tapered Roller* **BEARINGS**